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*International Federation of Master Cotton
Spinners' and Manufacturers' Associations*

INDIAN COTTON

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Report by
ARNO S. PEARSE,
*Secretary, on his Third Visit to India,
October, 1913—February, 1914*

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INTRODUCTION.

At a meeting of the committee of the International Federation of Master Cotton Spinners' and Manufacturers' Associations, held at Scheveningen, June 10th, 1913, the following resolution was unanimously adopted :—

“ That the Secretary proceed during the winter months to India in order to make further investigations in the cotton-growing districts of that country.”

Acting on this resolution I proceeded to India in October, 1913, and I had the pleasure of presenting to the meeting of the International Committee, held at Paris, June 12th, 1914, a full account of my investigations into the cultivation of cotton in India, as well as the conclusions I have arrived at regarding the improvement of Indian cottons and the extension of the area of cotton cultivation.

My journey extended to every cotton-growing province of India. Had it not been for the excellent arrangements made on my behalf by the Secretary of State for India, it would have been impossible for me either to have carried out so large an itinerary, or to have worked so profitably, as I was able to do, during the five months I spent in the country. At every stopping-place I was met by one or more officials of the Government, and accompanied by these gentlemen, I proceeded into the heart of the cotton growing districts, where meetings with cultivators took place. I had thus the opportunity of receiving first-hand information from the cultivators, exporting firms, and ginners; Government officials also placed their extensive experience at my disposal.

For the invaluable official assistance rendered me I am deeply indebted to the Secretary of State for India, the Marquess of Crewe, K.G., and to many gentlemen in India, who not only supplied me with information, but who entertained me in the most hospitable manner when my investigations led me into out-of-the-way districts.

My first journey to India was undertaken in 1909-10, and I may claim that since that time an increased interest in the cultivation of cotton has been displayed throughout the country, not only by the cultivators, but also by the Government of India, whose officials have evidently given careful attention to the publications issued from time to time by the International Cotton Federation.

In this report I propose to deal with the conditions in each of the provinces I visited, separately. Generalisation is almost impossible, owing to the different conditions of climate, soil, people, &c. A few general remarks, however, on the Geography of India, on the Method of Administration, Land Revenue and Tenure System, Irrigation, Co-operative Credit Societies, and Agriculture in general appear to me to be desirable.

I shall frequently quote figures and explanations from the "Statement Exhibiting the Moral and Material Progress and Condition of India during 1911-12 and the nine preceding years," a Blue Book, issued by the Under-Secretary of State for India, Sir Thomas W. Holderness, K.C.S.I. This book has been extremely useful to me in my endeavour to get a real insight into the conditions appertaining to India and her people.

My itinerary included the following important centres, from most of which I made excursions into the country :—

Sind.—Karachi, Hyderabad, Mirpurkhas, Sukkur, Shikarpur.

Punjab.—Lahore, Amritsar, Lyallpur, Lower Bari-Doab Colony.

N.W. Frontier Province.—Peshawar.

Delhi.—Delhi.

United Provinces.—Aligarh, Cawnpore, Kasganj.

Madras.—Nandyal, Hagari, Madras, Coimbatore, Tiruppur, Somanur, Koilpatti, Virudupatti.

Central Provinces.—Nagpur, Akola, Amraoti, Wardha, Sindhia.

Burma.—Rangoon, Mandalay, Mahlaing, Pakokku, Allammy, Thayetmyo, Myingyan, Minbu, Prome.

Assam.—Kamarpur, Shillong.

Bombay.—Ahmedabad, Sind, and Baroda.

Time did not permit of my visiting the southern part of Bombay Presidency, but the Director of Agriculture kindly gave me detailed information of the development that had taken place there since my visit in 1912.

At Coimbatore I attended a meeting of the Board of Agriculture and was invited to deliver an address. The address, which dealt with several of the points mentioned in this report, has been published by the Government of India in the records of the meeting.

At Bombay, Cawnpore, and Ahmedabad I addressed the mill-owners, giving them a résumé of this report.

Owing to the outbreak of the European War, the publication of this report has been considerably delayed.

ARNO S. PEARSE,

Secretary.

MANCHESTER,

June 2nd, 1915.

TABLE OF COINAGE, WEIGHTS & MEASURES.

1 Pie	= $\frac{1}{12}$ penny.
1 Pice	= 3 pies = $\frac{1}{4}$ d.
1 Anna	= 12 pies = 1 penny.
1 Rupee	= 16 annas = 1s. 4d. = Fcs. 1·66 = M. 1·36 = 0·324 dollar = 0·65 yen.
1 Lakh	= 100,000 rupees.
1 Crore	= 100 lakhs.

The weights adopted in Government transactions and by the railway companies are as follows:—

1 tola	= 180 grains	= 11·66 grammes.
1 chittak (5 tolas)	= 900 grains	= 58·32 grammes.
1 seer (16 chittaks)	= $2\frac{1}{2}$ troy lb. (or $2\frac{2}{3}\frac{2}{5}$ lbs. avoird.)	= 933·10 grammes.
1 maund (40 sers)	= 100 troy lb. (or $82\frac{2}{7}$ lbs. avoird.)	= 37·32 kgms.

CURRENT WEIGHTS IN THE DIFFERENT DISTRICTS:

KHANDESH.

80 Tolas	= 1 Seer.
40 Seers	= 1 Maund = $82\frac{2}{7}$ lbs.
3 Maunds	= 1 Pulla = 246·91 lbs.
1 lb.	= 38·88 Tolas. 1 Seer = $2\frac{2}{5}$ lbs.
1 Bombay Candy	= 784 lbs.

BERAR.

28 lbs.	= 1 Maund.
10 Maunds	= 1 Boja.

CENTRAL PROVINCES.

80 Tolas	= 1 Seer.
<i>Pulgaon and Wardha.</i>	
11 Seers	= 1 Maund = $22\frac{9}{16}$ lbs.
15 Maunds	= 1 Boja = $12\frac{1}{8}$ Quarters.
<i>Nagpur.</i>	
12 Seers	= 1 Maund.
14 Maunds	= 1 Boja.

BARSI AND NAGAR.

80 Tolas	= 1 Seer.
40 Seers	= 1 Maund.
3 Maunds	= 1 Pulla.

BARSI (NIZAM'S DOMINIONS).

80 Tolas	= 1 Seer.
12 Seers	= 1 Maund.
$10\frac{1}{2}$ Maunds	= 1 Boja = 259 $\frac{1}{4}$ lbs

KARNATAK (KUMPTA).

<i>Bijapore.</i>	
25 lbs.	= 1 Maund.
8 Maunds	= 1 Atki = 200 lbs.

Bhagalkote.

25lbs. = 1 Maund.

12 Maunds = 1 Barmani = 300lbs

Dharwar, Gadag, and Hubli.

28lbs. = 1 Maund (1 Quarter).

12 Maunds = 1 Barmani = 336lbs.

THE WESTERNS.

25lbs. = 1 Maund.

12 Maunds = 1 Barmani Boja.

SURAT.

37 03 Tolas = 1 Seer.

40 Seers = 1 Maund.

21 Maunds = 1 Candy = 800lbs.

BROACH.

40 Tolas or } = 1 Seer.
41 Rupees }40 Seers = 1 Maund = $42\frac{1}{6}$ lbs.21 Maunds = 1 Candy = $885\frac{3}{4}$ lbs.

KATHIWAR.

Wadhwan.

40 Tolas = 1 Seer.

40 Seers = 1 Maund = 41.15lbs.

Bhavnagar and Dhulia.

40 Tolas = 1 Seer.

40 Seers = 1 Maund = $42\frac{1}{7}$ lbs.24 Maunds = 1 Candy = $101\frac{2}{7}$ lbs.*Amreli and other places.*25 Maunds = 1 Candy = $1028\frac{4}{5}$ lbs.

BENGAL.

104lbs. = 1 Maund of Cotton.

 $82\frac{2}{7}$ lbs. = 1 Maund of Kapas.

Cotton sold by Maunds of 40 Seers or 104lbs. ... 1 Seer = 2.60lbs.

TINNEVELLY.

500lbs. = 1 Candy.

BURMA.

1 Viss in towns and municipalities = 3 60lbs., up-country
often = 3.65lbs., and frequently stone weights are used.

Equivalents of the Metric System.

1 English acre = 0.40 hectares.

1 measured ton = 40 English cubic feet = 1 13 cubic metre.

1 gallon = 4.5 litres.

1 English cwt. = 112lbs. avoirdupois = 50.75 kgms.

1 English pound = 0.453 kgms.

1 English weight ton = 1,016 kgms.

INDIA

SHOWING RAILWAYS

Open and under construction on 31.3.12

Scale 1:1,000,000

REFERENCES

1. 1st. 12. 1911	2. 1st. 12. 1911
3. 1st. 12. 1911	4. 1st. 12. 1911
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95. 1st. 12. 1911	96. 1st. 12. 1911
97. 1st. 12. 1911	98. 1st. 12. 1911
99. 1st. 12. 1911	100. 1st. 12. 1911

The map was compiled and revised during the period from 1st April 1911 to 31st March 1912.



PART I.

Geographical Notes.

Administration.

Department of Agriculture.

Agriculture.

Co-operative Credit Societies.

Caste System.

Village Systems.

Land Revenue and Tenure.

Irrigation.

Part 1.

GEOGRAPHICAL NOTES.

India extends from lat. 37° to lat. $8^{\circ} 4' N.$, a distance of over 2,000 miles, and from $66^{\circ} 44'$ to 101° E. long., a distance of about 2,600 miles. The British Empire in India covers about 1,833,000 square miles. It thus represents one-sixth of the inhabited area of the world. The

total population, according to the Census of March 10th, 1911, was over 315,000,000. The average density of population is estimated to be 184 per square mile, but the distribution is far from being even throughout the country; rain-fall, climate, and soil all have their effect, the greatest density being in Bengal, with an average population of 552 per square mile. After this come the United Provinces. The density in Upper Burma and the North Western Frontier is the least, due no doubt to the mountainous character of the country. There are 730,000 villages in India, and although she possesses over 2,000 towns, with a population varying from 5,000 to 1,000,000, still the largest percentage of the people live in the villages; in fact, about 200,000,000 persons are directly dependent upon agriculture proper and upon cattle rearing. Many persons combine agriculture, as a subsidiary pursuit, with some other occupation; thus we find, for instance, that the mill hands of Bombay absent themselves for two or three months in the year from their mill work in order to cultivate their land. It has been estimated that nine-tenths of the total population are so closely connected with agriculture that they may be properly classed as agricultural. There is a slight excess of males over females. The female population of India is of comparatively little value in the labour market as, owing to religion and custom, many are prevented from engaging in any labour outside their homes. The efficiency of labour generally

Health. is greatly impaired by the extreme heat of the summer, the want of pure water, and by the presence of malaria, plague, cholera, and enteric fever. Malaria has not, as a rule, fatal results, but it undermines the constitution, and for want of warm clothing pneumonia often follows. Death from pneumonia is often attributed to malaria. The plague has, during the last few years, diminished. It is a disease which is more violent during cold weather than during hot weather. Cholera demands a yearly toll of about 400,000 people. Small-pox is diminishing rapidly owing to the spread of vaccination. Whilst the average death rate in British India was, during 1911, 31.5 per thousand, the mortality among the troops was remarkably low, being 4.9 per thousand for British troops and 4.5 per thousand for native troops—figures which compare most favourably with the death rate of troops in Europe. This shows that if more adequate sanitary measures were instituted, many lives would be saved. The birth rate in India is 37.5 per thousand. Religion and social custom favour marriage of all persons before the age of puberty. The

proportion of celibates in India is therefore much lower than in any other part of the civilised world.

Income per Head of Population. It is stated that the annual value of the average farm production per head is Rs. 40. Lord Curzon computed the average income per head at Rs. 30. Others maintain that the figure is too high. The annual income per head of the population of the United Kingdom is £37, of the United States £39, of France £27.8, Germany £22.2. The wealth per head of the population in India has been estimated as being between £10 and £25, of the United Kingdom £302, France £252, United States £216, Germany £156.

Banerjea sums up the economic position as regards production in India as follows:—

“The productive capabilities of India are great. She possesses an abundance of natural resources and a plentiful supply of cheap labour, but she lacks capital, enterprise, and organisation. The defects are, however, remedial, and, as a matter of fact, attempts are being made to overcome them.”

Native States. The Native States in the British Empire of India consist of 693 units—some of them might be considered only small holdings, but others, for instance, Cashmir and Hyderabad, extend over 80,000 square miles. The distribution of area and population between British India and the Native States is as follows:—

—	Total Area.	Population of Area covered by Census.
	Square miles.	
British India	1,124,000	244,267,542
Native States	709,000	70,888,854

Under the term “Native States” is included a very large number of territorial units, variously situated in all parts of India, and differing among themselves in the widest possible manner in size and importance, but having in common this feature, that they consist of territory which does not form part of His Majesty’s dominions, but is under his suzerainty. A Native State has been defined as being “a political community, occupying a territory in India of defined boundaries, and subject to a common and responsible ruler who has actually enjoyed and exercised, as belonging to him in his own right duly recognised by the supreme authority of the British Government, any of the functions and attributes of internal sovereignty.” These latter functions and attributes may be divided in various proportions between the ruler of the State and the Suzerain Power. Some States enjoy a substantial immunity from interference in nearly all functions of internal administration; others are subject to much stricter control. Except that they come within the scope of the same general designation, the States at one end of the scale—such as Hyderabad, with an area of over 82,000 square miles, and a population of more than 13 millions—have little in common with those at the other, which may consist of only a few villages, or may be little more than small holdings.

The general nature of the relations between British India and the Native States is that the Chiefs have no power to enter into relations with other Native States or with foreign powers. They enjoy protection by the Government of India against dangers from without, and the Government also protects them in their own States.

The Suzerain Power claims a right to intervene in cases of grave misrule, or to prevent disputed successions or rebellion, or the dismemberment of a State by division or legacy. The Government of India has interfered also, when necessary, to prevent infanticide, *sati*, slavery, or barbarous punishments. The Native States are required to provide for the safe transit of Imperial mails in their territories, and to afford such facilities in this connection as are necessary in Imperial interests. The British Government also controls the general system of railway, telegraphic, and telephonic communications in India. There are, on the other hand, many matters of common welfare in regard to which the British Government tenders advice, but waits for the willing co-operation of the Native Princes: such are reforms of administrative or revenue systems, and currency.

Many of the States pay tribute, varying in amount according to the circumstances of each case, to the British Government. This tribute is frequently due to exchanges of territory or settlement of claims between the Governments, but is chiefly in lieu of former obligations to supply or maintain troops. The actual receipts in the form of tribute and contributions from Native States in the year 1911-12 were £595,005.

Political officers representing the Suzerain Power reside in the Native States, in the larger ones the Government of India is represented by a "Resident"; where States are grouped together there is a single agent assisted by local residents or political agents.

Physical Distribution. The Himalayas, which form the northern boundary, are the source of the great rivers, and this mountain range, with its eternal snow peaks, acts as a barrier to the clouds sweeping across the country from the Indian Ocean. These mountains have a most important bearing upon the soil and the climate, as well as upon the physical well-being of the population. Two natural physical divisions suggest themselves for India, viz., the Northern Plain, fed by the Indus, Ganges, and Brahmaputra river systems, and the Southern Peninsula, which is separated from the Northern Plain by the Vindhya Mountains, and which is really a plateau.

The most extensive, and, agriculturally, the most important tracts of land are those formed of alluvial soil, such as we find in Sind, Rajputana, United Provinces, Bengal, Assam, Burma, Madras, and in the Central Provinces.

Climate. In the northern part of India there are the extremes of excessive heat in summer and bitter cold in winter; but in Assam and Bengal the winter is milder, the difference in the temperature between summer and winter not being so great. The western tracts are very dry, whilst in the east the atmosphere is practically always charged with moisture. The difference between winter and summer temperature is only slight in the whole of the peninsula, due to its elevated position.

Monsoons.

In April and May the heat begins to make itself severely felt in the Northern Plains of India, with the result that the air over the land becomes much hotter than it is over the sea. The hot air ascends and the cool air from the sea rushes in to take its place. An atmospheric current from the Equator to the north is thus established, and having originated over the ocean, carries with it considerable moisture from the sea. This is briefly the explanation of the south-west monsoon which reaches Bombay and Bengal between the second and third week of June. Within three weeks the monsoon usually extends over the whole of Northern India. This monsoon generally continues until September, and 90 per cent. of the total rainfall of India is due to it.

North-east Monsoon.

When the temperature over the land becomes lower than over the surrounding sea, *i.e.*, in October and November, the winds begin to blow in the opposite direction, and, as they originate on land, they do not carry much moisture. It is for this reason that these autumn winds are called dry monsoons, or north-east monsoons. The moisture which these winds do bring is probably due to what remains from the south-west monsoon, lingering about in proximity to the Himalaya mountains. A certain amount of moisture is also collected by this north-east monsoon on its passage from Assam across the Bay of Bengal, and thus it is that a considerable portion of the Madras Presidency, especially the south east, gets considerable quantities of rain. As we shall see later, this rain is of special value to the growing of cotton in that Presidency. As the south-west monsoon does not cover a great deal of Madras, it is the north-east monsoon that is of greater economic importance to that province.

The progress of the monsoon, especially the south-west monsoon, is watched with great interest, not only in India, but all over the civilised world. The failure of the monsoon, as can be readily imagined, is a very serious matter.

Government has done a great deal to make certain tracts of country, especially in the north of India, independent of the rainfall, and in a later chapter I shall speak of the great irrigation works, some of which have been constructed, and others projected. The rainfall in India varies very considerably; figures will be given in my remarks dealing with the separate provinces. The North West Province, Punjab, Sind, and parts of the United Provinces never receive as much rain as would suffice for the cultivation of cotton.

Kharif and Rabi.

The cultivation of cotton, and of all the staple crops, is to a great extent regulated by the rainfall periods, and thus we have two main crops—Kharif (autumn) system of crops, sown at the beginning of the south-west monsoon in June and July, and harvested between September and December, and the Rabi (spring) crops, sown in October and November and harvested in spring. Cotton is a Kharif crop in the north, but in the south, in Madras Presidency, with its more uniform climate, a close differentiation between Rabi and Kharif is not made.

ADMINISTRATION.

The system under which British India is governed is described in the following paragraphs, extracted from the Blue Book before-mentioned, and from the Indian Year Book.

Secretary of State.

“ India is governed by, and in the name of, the King-Emperor. The authority of the Crown over India is exercised in England through the Secretary of State, who inherits, subject to the rights of the Council of India, and to the powers reserved to itself by Parliament, all the powers and duties, relating to the government or revenues of India, of the Board of Control and of the East India Company, and who, as a member of the Cabinet, is responsible to, and represents the authority of, Parliament. In certain matters, including the expenditure of Indian revenues and the raising of loans in Great Britain, the Secretary of State cannot act without the concurrence of a majority of votes at a meeting of the Council. In all other matters, the determination of the Secretary of State is final. All orders proposed to be issued, or communications proposed to be sent to India, must, however, be submitted to a meeting of the Council, or placed in the Council Room for seven days for perusal, before they are issued or sent, unless they deal with secret matters or the action proposed is, in the opinion of the Secretary of State, urgently required. In the latter case the Secretary of State must record his reasons, and notice must be given to every member of the Council.

The Council of India.

The Council of India conducts under the direction of the Secretary of State the business transacted in the United Kingdom in relation to the government of India, and the correspondence with India. One meeting of the Council at least must be held in every week. The powers of the Council and its position in relation to the Secretary of State are defined by the Act of 1858; it is, as has already been indicated, in the main a consultative body, with a limited veto, and without the power of initiation.

The Council consists at the present time of 12 members, of whom 10 have served in various capacities in India. The other two members have special knowledge of finance. Since 1907 the Council has included two Indian members. From the Council are appointed seven committees, to which matters connected with the various branches of the administration are referred before being finally laid before the Secretary of State in Council.

The India Office.

Associated with the Secretary of State and the India Council is a secretariat known as the India Office, housed at Whitehall. The Secretary of State has two Under-Secretaries—one permanent, the other parliamentary—to whom some of his minor duties are delegated. Appointments to the establishment are made by the Secretary of State in Council, but “junior situations” must be filled in accordance with the general regulations governing admission to the Home Civil Service.

The whole cost of the India Office is borne by the revenues of India. It amounts to £357,000 a year.

The Viceroy and Governor-General. The supreme authority *in* India is vested by a series of Acts of Parliament in the Governor-General in Council, subject to the control of the Secretary of State. At the head of the Government is the Governor-General, who also, as the representative of the King, bears the title of Viceroy. He is appointed by the Crown, and usually holds office for a term of five years. Under specified conditions and in specified circumstances, power is reserved to the Governor-General to act alone and independently of his Council. Thus he may, "in cases of emergency," make and promulgate "ordinances for the peace and good government" of British India, or any part thereof, which, subject to certain conditions, have the force of law for a period not exceeding six months. He has power also to overrule a majority of his Council in regard to measures "whereby the safety, tranquillity, or interests of the British possessions in India, or any part thereof, are or may be, in the judgment of the said Governor-General, essentially affected." These are powers only rarely exercised. He has also by law certain powers of control over legislation. Measures relating to the public revenue or debt, religion, military, or naval matters, or foreign relations, may not be introduced in any of the legislative councils without his previous sanction, and all Acts require his assent. In the case of a measure passed by his own Council, he has, besides the power of withholding his assent, the third alternative of reserving the law for the signification of the Royal pleasure.

The Executive Council. Apart from the few special provisions referred to above, the Governor-General has no power to act otherwise than in Council (where he is ordinarily bound by the decision of the majority), or by the implied authority of the Governor-General in Council. All official acts of the central Government run in the name of this corporate body, which is commonly and properly described (the usage being recognised by an Indian Act) as the Government of India. In the Governor-General in Council is vested "the superintendence, direction, and control of the whole civil and military government" of British India.

The Executive Council consists of six "ordinary" members, appointed by warrant under the Royal Sign Manual, and of the Commander-in-Chief in India, who is, under the statute, an "extraordinary" member appointed by the Secretary of State in Council at his discretion. The term of office is, by custom, five years. Of the ordinary members, three must have been at the time of appointment in the service of the Crown in India for at least 10 years, and one of the others must be a barrister or advocate of not less than five years' standing. At least five ordinary members must be appointed. To each member is allotted, as his special province, the charge of one or more of the departments among which the business of the Government of India is distributed. At present the Foreign Department is under the Governor-General, the Army Department under the Commander-in-Chief, and the Finance, Home, Commerce and Industry, Education, and Legislative Departments have each a separate member, while

the Public Works Department is a joint charge with the Department of Revenue and Agriculture under Sir R. W. Carlyle, K.C.S.I., C.I.E.

For the purposes of legislation, and to bring the administration into close touch with public opinion, the Executive Council is expanded by additional members into a great legislative assembly.

The Imperial Legislative Council. The Imperial Legislative Council took its present shape under what is commonly called the Morley-Minto reform scheme of 1909, and was embodied in the Indian Councils' Act of that year. Two principles run through this scheme: (1) To secure the fair representation of all the varied interests in the country, and (2) to give the Council a real influence in determining the character of the administration.

At present there are elected 27 members, a like number of officials, and five non-official members are nominated. The Government has an official majority on the Council, but in any case the Government is not bound to act on the resolutions of the Council.

All members of the Imperial and Provincial Legislative Councils are entitled to the prefix "Honourable Mr." during their term of office.

The Secretariat. The Secretariat of the Government of India is at present divided into nine departments, enumerated above, each under a Secretary. It is the duty of a department, when a question comes up for consideration, to prepare and submit to the member of Council in charge the papers on the subject. If a question is taken before the Council, the secretary of the department concerned attends during its discussion and records the orders passed. The nine departments between them cover the whole field of administration; to each is assigned a number of heads of business, and it should be noted that though the names, by which the departments are known, indicate generally the nature of their work, they are not to be taken as defining their scope exactly. Thus the Education Department, besides dealing with education, deals with other highly important subjects, including sanitation and municipalities. Most sources of revenue—opium, salt, stamps, excise, and assessed taxes—fall within the province of the Finance Department. The Revenue and Agriculture Department is concerned, as regards revenue, only with land revenue.

The Provincial Governments. Each of the 15 provinces into which British India is now divided has its own local Government. In constitution and status the local governments differ widely. All of them alike are under the superintendence and control of the Governor-General in Council, but the degree to which the authority of the Governor-General in Council is in practice brought to bear is graduated in accordance with the differences in status between the provincial governments.

The local governments at the present time fall into five classes, the first including Madras, Bombay, and Bengal, administered by Governors in Council; the second including only Bihar and Orissa, administered by a Lieutenant-Governor who, like the Governors, has an executive as well as a legislative council; the third consisting of

the remaining lieutenant-governorships—of the United Provinces, the Punjab, and Burma—with legislative councils only; the fourth consisting of Assam, the only Chief Commissionership so far provided with a legislative council; and the fifth comprising the remaining Chief Commissionerships, of which the Central Provinces, the North-west Frontier Province, British Baluchistan, and the new province of Delhi are the most important.

Relation of the Government of India to Provincial Governments. The Governor-General in Council is responsible for the entire administration of British India and for the control exercised in varying degrees over the Native States. In practice, the Government of India retains in its own hands matters relating to foreign relations, the defences of the country, general taxation, currency, debt, tariffs, ports, telegraphs, and railways. Ordinary internal administration, the assessment and collection of the revenues, education, medical and sanitary arrangements, and irrigation, buildings, and roads fall to the share of the provincial governments. But in all these matters the Government of India exercises a general and constant control, and lays down lines of general policy.

Provincial Secretariats. Each province has a secretariat, of a strength proportionate to its administrative requirements. The arrangements for the disposal of business are on the same general lines as in the Government of India Secretariat, but the departments and secretaries vary in number and in name.

District Administration. The Indian system of administration is based on the repeated subdivision of territory, each administrative area being in the responsible charge of an officer who is subordinate to the officer next in rank above him. The most important unit is the “district”; and a province may be regarded as consisting of a collection of districts, which is usually split up into subdivisions, and these again into smaller circles. British India contains some 267 districts; the average area of a district is thus over 4,000 square miles, and the average population over 900,000. The actual districts vary greatly in size and density of population. The Vizagapatam district, in Madras, has an area of 17,223 square miles with a population of over three millions; the Upper Chindwin district, in Burma, has an even larger area, of over 20,000 square miles, but a population of only 170,000; while the Mymensingh district, in Eastern Bengal, has a population of over 4½ millions on an area of 6,347 square miles. Very few districts have an area of less than 1,500 square miles, or a population of less than half a million.

The “Collector” and Magistrate is the representative of the Government in the district under his charge; as his two-fold appellation indicates, he is both the principal revenue official and the chief magistrate. He is concerned in the first place with the land and the land revenue, and with all matters affecting the condition of the peasantry; he has charge also of the local administration of excise, income tax, stamp duty, and other sources of revenue, and he is responsible for the management of the district treasury.

In addition to these two main departments of work, the Collector has to interest himself in all matters affecting the well-being of the people. In some branches of the administration his functions are, in consequence of the formation of special departments, such as those of public works, forests, sanitation, and education, less direct than was formerly the case, but even in these cases his active co-operation and counsel are still needed. He is also usually the chairman of the district board, and guides and controls to a large extent the working of municipal institutions. For the proper discharge of his many duties, the Collector-Magistrate must be accessible to and intimately acquainted with the inhabitants of his district, and accordingly spends, as a rule, several months of the year in camp, visiting all parts of the area under his charge.

The Collector-Magistrate has the assistance of a large staff of subordinate officers, some of whom are his assistants at head-quarters, while others hold charge of portions of the district. In general the districts are split up into "subdivisions," under junior officers of the Indian Civil Service or members of the provincial service, styled Deputy Collectors, and these again into minor charges bearing different names and held by officers of the subordinate service. The subdivisional officer has, under the control of the Collector, general charge of the executive and magisterial administration of his subdivision. The administrative arrangements within the subdivision vary considerably in different provinces. At the basis of the system the Indian village organisation, which is of great antiquity, still finds its place, with the modifications necessitated by the greater control and complexity of our system of government, in the fabric of British rule. Of the village officials, who are largely hereditary, the most important are the headman, who collects the revenue and in some provinces, particularly in Madras and Burma, may be also a petty magistrate or civil judge; the *karnam*, *karkun*, or *patwari*, who keeps the village accounts, registers of holdings, and in general all records connected with the land revenue; and the *chaukidar* or village watchman, who is the rural policeman.

**The
Civil
Services.**

The Civil Service in India, through whom the general work of administration and, for the most part, the administration of justice, are carried out, consists as at present constituted of three branches—the Indian Civil Service, recruited in England, which corresponds to the old Covenanted Civil Service; and the Provincial and Subordinate Civil Services, recruited in India from among natives of India.

The total sanctioned strength of the Indian Civil Service cadre (including the posts held by military officers in the commissions of some provinces) at the end of the period under review was 1,341; the actual strength was rather greater, that of the Indian Civil Service itself being about 1,300, including 60 or 70 Indians. The total number is no greater than is required to fill the majority of the highest offices, with such a proportion of less important posts as provides a course of training for the younger men. Twenty-four Indians entered the service during the last decade through competitive examinations held in England. The members of the provincial services (styled the Bengal Civil Service, the Madras Civil Service, and so on) fill the important executive, judicial, and administrative posts not held by members of the Indian Civil Service.

The total strength of the provincial services is about 2,450, of whom the great majority are Indians. The service is divided into executive and judicial branches, the former including appointments of deputy collector and magistrate, &c., and the latter those of subordinate judge, &c. The subordinate services include the holders of minor posts, including the lower grade appointments formerly held by the Uncovenanted Civil Service."

**Small
Number of
British
Officials in
Comparison
with Indians.**

It is astonishing how few are the places occupied by Britishers in the administration of British rule in India. The Indian Civil Service Officials, with many of whom I had the pleasure of coming into close contact, are a body of men of exceptional ability and versatility. After a journey through India one cannot help but have the greatest admiration for that small body of men, who administer that vast stretch of country and control so large a population under difficulties which the average European cannot imagine. The Indian political agitator may complain that Indians do not receive a fair share in the distribution of the posts in the Government offices, but these complaints are absolutely unfounded.

Sir T. Bampfylde Fuller, himself a retired member of the Indian Civil Service, aptly says: "The members of this service have generally shown the capacity which is awakened by responsibility in men of British race; with ample salaries they have hardly been tempted by dishonesty, and their detached impartiality has not been disturbed by the importunity of friends or relations. To the credit of their nation they have established and maintained a government which, for its resources, is exceedingly efficient, and, in one honourable respect—its solicitude for the poor—has probably been the most painstaking the world has ever known. The chief defect of the service has been a jealousy of its privileges."

The Indian Civil Servant treats the Indians with all consideration, and as a rule the members of the Service are respected by them.

**India's Revenue
and Expenditure.**

The following table gives the total annual Imperial and Provincial revenue and expenditure for the last decade:—

	Revenue.			Expenditure.		
	In India.		In England	In India.		In England
	Imperial.	Provincial.		Imperial.	Provincial.	
	£	£	£	£	£	£
1902-03	47,204,780	17,397,280	694,805	26,469,769	17,397,280	18,361,821
1903-04	51,118,372	19,104,009	746,744	30,721,302	19,104,009	18,146,472
1904-05	52,324,849	18,152,004	636,103	30,041,119	18,152,004	19,463,757
1905-06	50,030,081	19,865,252	951,232	30,271,620	19,865,252	18,617,465
1906-07	50,472,873	21,798,272	874,465	30,549,556	21,798,272	19,208,408
1907-08	48,443,585	21,841,053	718,637	30,368,909	21,841,053	18,487,267
1908-09	44,987,891	24,171,904	601,740	30,402,182	24,171,904	18,925,159
1909-10	48,810,211	25,072,077	711,207	29,791,861	25,072,077	19,122,916
1910-11	52,851,503	26,855,113	975,857	30,309,510	26,855,113	19,581,563
1911-12	53,146,077	28,597,262	1,092,411	30,340,497	28,597,262	19,957,657

The principal sources of revenue of the Imperial and Provincial Governments are as follows :—

	Imperial.	Provincial.
	£	£
Land revenue (excluding that due to irrigation)	7,691,143	13,073,554
Opium	5,961,278	—
Salt	3,391,212	—
Stamps	2,442,874	2,372,255
Excise	2,262,357	5,347,396
Provincial rates	906	547,774
Customs	6,468,567	—
Assessed taxes	912,434	740,444
Forests	69,214	1,882,965
Registration	4,493	441,369
Tributes	595,005	—
Total	29,799,483	24,405,757

The land revenue, which is by far the largest item, has shown a steady upward tendency during the last decade, having increased during that period by 14·2 per cent. This is a very satisfactory state of things.

The following table shows for each Province separately the amount by which the total revenue collected in it in the last two years of the decade exceeds or falls short of the total expenditure incurred by the Province. The figures show how much each province contributed towards the expenditure of the Government of India, both in India and in England :—

Provinces, &c.	1910-11.		1911-12.		Provincial Balance, 31st March, 1912.	Increase or Decrease of Balance, 1911-12
	Excess of Revenue.	Excess of Expenditure.	Excess of Revenue.	Excess of Expenditure.		
	£	£	£	£	£	£
Bengal.....	9,905,421	—	8,511,764	—	1,424,967	553,082
E. Bengal and Assam ..	652,373	—	537,732	—	833,900	347,920
U. Provinces	3,005,516	—	2,260,342	—	588,982	9,616
Punjab	1,255,578	—	1,493,950	—	691,536	226,537
Burma.....	2,221,465	—	2,280,092	—	276,535	84,003
C. Provinces and Berar	308,083	—	293,535	—	265,786	80,972
Madras	4,538,970	—	4,562,551	—	1,235,240	195,900
Bombay	4,926,962	—	5,248,966	—	726,149	360,941
N. W. F' tier Province	—	370,407	—	384,784	—	—
India, General	—	3,901,968	—	1,998,569	—	—
England	—	18,605,706	—	18,865,246	—	—
Net result	Surplus £3,936,287		Surplus £3,940,333		—	Net Provincial Surplus £969,083

DEPARTMENT OF AGRICULTURE.

Each province has its own Department of Agriculture, at the head of which is a Director, who is a member of the Indian Civil Service. Although few of the Directors have had a special training in agriculture, one cannot but be impressed by the knowledge they have acquired of the principles of the agricultural work carried on in the various provinces. In most cases the Directors of Agriculture have acted as "settlement" officers, and in their work of assessing land values they have acquired a thorough knowledge of the people, and of their language, as well as of local customs. The Directors of Agriculture are assisted by Deputy-Directors, who are the technical experts of the Department. These Deputy-Directors, in addition to their training at a British University, are possessed of practical experience in agriculture. With two exceptions these gentlemen are Britishers (mostly Scotchmen). There are some Assistant Deputy-Directors, and each Government farm has one or two Farm-Managers. The Farm-Managers, who are all Indians, have passed through one of the Indian Agricultural Colleges and obtained a degree in agriculture. So far as the technical experts are concerned, I wish to say that their number is too small. In my account of the work in each province I shall mention some of the great benefits which have followed the employment of these gentlemen. At one time it was the earnest wish of the Government of India that Indians should occupy the higher posts in the Agricultural Department, but at the present time Indians with the necessary qualifications cannot be found. Although a man may be an able student, and may have obtained a high position at his University, still it cannot be maintained that he is, therefore, the right man for pioneer work in practical agriculture. There is not only in India, but also in Great Britain, in fact, all over the world, a scarcity of agricultural experts. This makes it all the more necessary that wherever suitable men can be found, the Indian Government should get into touch with them. I think it would be advisable if the Government of India were to inform the British Universities that every year situations could be found for a certain number of trained agricultural experts. It would be easy also to arrange for those agricultural experts from India, who may be in England on leave, to give lectures on Indian agriculture at the Universities and thus stimulate the desire amongst students to take up work in India and to receive a suitable preparation. I feel sure the Universities would welcome such a step, as it would bring them into closer touch with modern agricultural developments in India. It must be observed that, at the present time, some of the agricultural experts come to India knowing practically nothing of the cultivation of Indian staple crops.

**Agricultural
Colleges.**

The need for more agricultural experts is acknowledged by the governors of every province. Some years ago, agricultural colleges were built in India in the hope that sons of Indian farmers and landowners would qualify for the higher posts under the Department of Agriculture. Experience has shown, however, that these colleges have been mostly used for the purpose of obtaining a certain amount of agricultural knowledge useful to the Revenue Officer, and thus we see the majority of students

drifting into the service of the Revenue Department, where the remuneration is higher than in the agricultural service. At the meeting of the Board of Agriculture at which I was present in Coimbatore, it was generally admitted by the Principals of these colleges that except in the case of one college the system adopted in the past had been a failure. The Principal of the Lyallpur Agricultural College stated that every graduate of his college cost the Government of India Rs. 11,000, and that during the last session not a single student had offered himself for the first year's course in agriculture.

**European
Expert less
costly than
Indian.**

A deputation of the International Cotton Federation which waited upon a Secretary of State for India was told "that the European is too expensive material to be employed on a large scale." If one bears in mind such figures as were supplied by the Principal of the Lyallpur College, I think it will be found that the

European is considerably less expensive than the Indian, seeing that his education has not cost anything to the Government of India. When an Indian is appointed to the rank of Deputy-Director he receives the same pay as the European.

**Expenditure
on Depart-
ment of
Agriculture.**

In 1911-12 the Government of India spent on the Department of Agriculture the insignificant sum of £215,667. This sum includes salaries of the great staff of teachers at the six provincial colleges, and would be further reduced if the accounts were kept on the lines of commercial concerns, for, strange to say, the produce

raised on the various farms and sold to the public, is not credited to the Department of Agriculture, but to Revenue Account. Thus I was unable to obtain the actual cost of the Department of Agriculture.

**Comparison of
Expenditure
with Other
Countries.**

The Government of India spends about £1 per thousand of the population on agriculture, leaving out veterinary expenditure. Comparisons with other countries show how absurdly small this outlay is. The United Kingdom spends £46 per thousand, Queensland £92.5, Austria £86.5, Prussia £62.5, United States of America and

Canada a little over £36, France and Hungary about £27. The "Pioneer" of Allahabad, which supplied this information, in a leading article dealing with an address I gave before the Board of Agriculture, says this comparison is very instructive and that no one can fail to see that State expenditure on agriculture in India is only in its infancy, and that an unanswerable case exists for its expansion.

**U.S.A. Depart-
ment of
Agriculture.**

The United States of America, according to the latest report of the Secretary of the Department of Agriculture, employed on July 1st, 1912, at the head office in Washington, 2,815 people, whilst 11,043 were employed in the country. Since 1897, when the first report

of the Department of Agriculture of the United States was issued, 11,414 additional employes have been engaged. Secretary Wilson, of the Agricultural Department, concludes his last annual report with the following paragraphs, which are well worth the consideration of the Government of India :—

"The record of 16 years has been written. It begins with

a yearly farm production worth \$4,000,000,000 and ends with \$9,532,000,000. Then, farmers were loaded with debts that were a painful burden; prosperity followed and grew with unexampled speed. Then, the farm was a joke of the caricaturist; now *he* is like the stone that was rejected by the builder and has become the head of the corner. Beginnings have been made in a production per acre increasing faster than the natural increase of population. There has been an uplift of agriculture and of country life.

"In this movement the department has been gradually equipped to occupy a foremost place. It came to learn and it remained to teach. Its influence penetrates the remotest neighbourhood. It performs a mission of welfare and happiness to farmers and to the whole nation. The million of dollars that it costs are returned in tens of millions of wealth saved and wealth produced."

Lack of Originality Among Indian Students. Reverting to the question of employment of Indians in the higher posts; at the meeting of the Board of Agriculture in Coimbatore there was almost unanimity of opinion amongst the higher officials that the Indians who obtained degrees at the Agricultural Colleges showed a lack of originality and that their learning savoured too much of "cramming." Considering that those who spoke in this way were at the head of the Agricultural Colleges, and of the Government farms, they should be well qualified to judge. No doubt there are occasional exceptions where we find an Indian able to apply his learning to practical farming. It is evident that the Agricultural Colleges of India aimed at too high a standard, and that the teaching staff was handicapped by the absence of elementary knowledge on the part of the students. The teaching at these Colleges is conducted entirely in English. During the last few years, however, experiments have been made with vernacular schools, which seem to have shown better practical results than the Colleges, and an extension is projected. The only Agricultural College which can claim to have succeeded in a moderate way is that at Poona, but even there a large number of Brahmins attend, viz., 45 out of a total of 110, and Brahmins do not, as a rule, engage in actual farm work.

Efficient Staff European Agricultural Experts, but too small.

I have come in contact with almost all the European agricultural experts in the whole of the cotton-growing provinces of India, and I cannot help but express my admiration of the able manner in which they perform their duties. Except in one or two cases they have obtained a command of the various languages spoken in their districts, and they ungrudgingly give the whole of the week, Sundays included, to their duties. The insufficiency of the staff of these experts becomes more

apparent if one considers the area which is placed under their charge. In Burma and Madras, for instance, each of the experts has an area of some 80,000 square miles to attend to. Under these conditions it is impossible to visit all the villages and districts even once in five years, much less can they acquire a personal knowledge of the important cultivators, or get to know the customs prevailing with

regard to agriculture. An agricultural expert who has such a vast territory will spend about one-third of the whole year on the railway, for trains in India do not travel fast, and stoppages of an hour or two at junctions are very frequent. Add to this the necessity for extended leave, owing to the climate, and one will recognise that India ought to have a staff of these valuable men equal to, if not larger than, that of any of the countries whose expenditure on agricultural departments is mentioned above. I could cite cases in every province where, through the instrumentality of the agricultural expert, the additional annual income to the cultivators is at least Rs. 1,000,000. In my opinion these agricultural experts, *i.e.*, farming experts, ought to have an opportunity of touring systematically in the same manner as the collectors.

Expected During the last few winter seasons a Royal Commission
Improvement has been considering the conditions of service, salary,
in Agricultural leave and pension of those employed by the public
Service. services in India, and it is anticipated that the financial
 position of the officials of the Department of Agriculture
 will in consequence of the evidence collected be considerably improved. The present remuneration cannot be said to be commensurate with the work, the disadvantages of life in India, and the dangers of the climate. It is expected that the Commission will recommend the promotion of the most experienced of agricultural experts to the posts of Directors of Agriculture, and that new posts of Rural Commissioners will be established, to be occupied by members of the Indian Civil Service. Their work will be the administration of all the departments concerned with agriculture, such as co-operative societies, veterinary department, and agricultural department proper.

AGRICULTURE.

The percentage of gross cropped area under the principal crops grown in India is as follows:—

—	1901-02.	1911-12.	—	1901-02.	1911-12.
Rice	30.8	30.8	Linseed .....	.9	1.5
Wheat	8.2	10.1	Sesamum	1.6	1.7
Barley	2.7	3.4	Rape and mustard	1.3	1.7
Jawar	9.6	7.4	Other oil-seeds	1.3	1.7
Bajra	5.8	5.3	Total, oil-seeds ..	5.2	6.6
Ragi	1.6	1.7	Cotton	4.5	5.9
Maize	2.7	2.2	Jute	1.0	1.2
Gram	4.3	5.7	Other fibres .....	.25	.28
Other grains and pulse	12.0	11.8	Indigo .....	.35	.11
Total, food-grains	77.8	78.4	Opium .....	.27	.09
Sugar	1.1	1.0	Tobacco .....	.42	.40
Coffee .....	.05	.04	Fodder crops	1.3	2.0
Tea .....	.22	.22			



Photo by Brenner & Co., Lahore.

The Ancient Persian Wheel.

It is frequently asserted that cotton cultivation cannot be extended except by a reduction in the cultivation of food crops. In dealing with this charge at the Coimbatore meeting, I said:—

“We were told by the Right Hon. Viscount Morley of Blackburn, O.M., when Secretary of State for India, that the extension of cotton would interfere with the growing of food stuffs, but according to Government statistics the percentage of the gross cropped area of India was:—

	Under food crops. Per cent.		Under fodder crops. Per cent.		Total, food and fodder crops.		Under cotton.
1901-02.....	79.17	..	1.3	..	80.2	..	4.5
1911-12.....	79.66	..	2.0	..	81.66	..	5.9

I think that fear has now vanished ; besides cotton requires a food crop for a rotation. Although the ryot may not be able to eat his cotton, as one official kept telling me on my journey, yet it pays him well, and with the help of the splendid railways he can purchase his food from other localities.



The Modern Persian Wheel, made almost entirely of iron ; all the bearings are ball bearings.

Even in famine years India exports food stuffs. Of course, the man who owns only half an acre must in the first instance devote his land to the raising of food crops. The cotton seed cakes, or better, the meal of these cakes, form, in all agricultural countries, an excellent cattle food which is not yet sufficiently used in India. The meal can be conveniently packed in a small compass, and can be transported expeditiously by rail to famine-stricken districts when necessary. These cotton seed cakes have found great favour in England and the United States, and one may justly look upon cotton more as a fodder-producing plant than as a fibre plant, seeing that the seed grains are the heaviest portion of the crop."

As I have pointed out, the villages are becoming less and less self-dependent. The cultivators grow that produce which pays them best, and their surplus earnings buy the produce which they cannot profitably grow themselves.

Rice. Rice is the staple food of a great portion of the people of India. The principal rice-growing provinces are Bengal, Bihar and Orissa, Madras and Burma, but every province in India has some rice cultivation.

Rice requires a great quantity of moisture, and the farmers seem to have a special liking for its cultivation, which affords them the opportunity of paddling about in water, as the fields require to be completely flooded. Lower Burma grows about 3,000 tons of rice, which is practically all exported.

Wheat. Wheat is the great cold weather crop of Northern India. The Punjab, United Provinces, and Central Provinces are the principal wheat-producing provinces, and cotton is there, with preference, rotated with wheat. The Agricultural Department has been very successful in introducing improved wheats. The adulteration of Indian wheat has been for many years a great drawback, but now a uniform percentage of admixture is allowed for in the exports.

Barley is another important crop in the north; it frequently follows cotton.

Millet. Millets, such as Jowar or Cholum (*Sorghum vulgare*) and Bajra, the large-grained millets, are the most important, and after rice these millets constitute the most common food of the people of India. The stems form an excellent cattle fodder.

Maize is also grown, especially in the north.

Pulse Crops. Gram (*Cicer arietinum*) is the principal pulse crop of the Punjab and the United Provinces, but other pulses are grown in all the provinces of India. Gram is extensively used as a cattle food.

Oil Seeds. Cotton seed, linseed, rape, mustard, sesamum, and ground nuts are the principal oil seeds. The seeds are to some extent crushed in the country. The illustration below shows the primitive method adopted in practically all parts of the country. The slanting beam crushes the seed in a round trough; the appliance is a pestle and mortar on a large scale, the pestle being driven round by a buffalo or camel, the cross bar acting as a seat for the driver. Often a child enjoys the ride as on a roundabout. Modern seed-crushing machinery is also at work, but there is still room for expansion.

The cakes from the oil seeds, *i.e.*, the refuse in the process of crushing, is an excellent manure, and in some cases very good fodder. The exports of cotton seed have risen from £309,000 in 1901-02 to £1,012,752 (representing 4,073,110 cwt.) in 1911-12. The soil is thus robbed of a great quantity of manure, and the cattle could well do with the additional food value contained in the grain. The exports of cotton seed show that additional crushing plant could be remuneratively employed.

Sugar Cane. The imports of sugar from Java (cane) and beet (from Europe) are as follows:—

1902-3	£164,500	1907-8.....	£295,400
1903-4	193,500	1908-9.....	340,000
1904-5	214,000	1909-10	367,400
1905-6	259,300	1910-11	411,100
1906-7	284,900		

This astonishing increase seems to have alarmed the Government of India, and every effort is being made to foster the cultivation of sugar cane. My personal opinion is that it is a wrong policy, as other parts of the world can produce the cane at much lower rates. Let the cultivator of India grow the crops he can produce most profitably. In spite of the favouring of sugar cane by Government, the acreage is decreasing. 1907-8 showed the largest acreage, viz., 2,706,000 acres, in 1911-12 it was 2,332,000 acres, estimated to yield 2,390,000 tons of raw sugar (gur). According to Prinsen Geerlig,



Primitive Oil Mills of this kind are found almost all over India.

the best-known sugar expert, the average out-turn in Java is 4 tons per acre, and I was informed by two agricultural experts in India, that no matter what is done, the *average* out-turn in India could not be increased to 2 tons per acre. It does, therefore, seem unwise to attempt to stimulate an industry which cannot possibly hope to compete with other parts of the world. It is true that some *isolated* tracts in Madras, Central Provinces, Bengal, and United Provinces can produce more than 2 tons per acre, but to endeavour to grow sugar on a large scale in the Punjab, for instance, seems economically unsound. Raw sugar, a kind of molasses, known as "gur" and "jogari," is very extensively consumed by the Indians. It is obtained in the following way. The canes are crushed in a hand mill by two rollers, and the juice is boiled down. The residue forms a cake, and this is consumed; it tastes very sweet and contains a considerable quantity of alcohol.

The increasing consumption of sugar is a sign of the improved financial condition of the people.

An interesting indication of the prevalence of a dishonest practice is observable in the custom of placing chunks of "gur" in bales of watered seed cotton. This is done with a view to silence the man who detects the moisture—a novel method of bribery.

Jute. Jute production is practically a monopoly of India, and in particular of Bengal, though small quantities are grown in Assam and in other provinces which have a heavy rainfall. The price of jute has risen enormously during the last few years, and the jute crop is equal to the cotton crop in value. About 4,000,000 acres was the maximum acreage ever planted. This yielded almost 10,000,000 bales of 400lbs.

Indigo is almost a negligible crop, having been ousted by the introduction of aniline dyes.

Tea. Tea cultivation is extending. There are about 4,500 plantations. Assam is the chief tea-growing province, having 738 plantations covering 1,192,000 acres, a third of which is planted. The estimated output of treated tea has risen from 191,000,000lbs. to 268,000,000lbs. in ten years. The



Outside most villages is a common on which all kinds of agricultural labour, such as threshing, winnowing, etc., is performed.

Tea Planters' Association in Assam is a powerful organisation, which the Government considers it wise to consult whenever the question of introducing new industries is discussed. Up till now the tea plantations of Assam have had the benefit of a system of indentured labour. This province, although possessing magnificent vegetation, is very sparsely populated. The average density varies from 406 persons to the square mile in the Surma valley to 126 in the Brahmaputra valley and 34 in the hills. The people of Assam, owing to the luxurious vegetation, object to working permanently, and thus the planters have had to import labour. Some 800,000 people have immigrated, principally from Chota Nagpur, Bengal, and the United Provinces. The importation of labour is very expensive, and a law has been enacted stipulating that an imported labourer must not leave his employer before the expiration of his contract, which must not exceed four years. As the demand for labour is much in excess of the supply,

the treatment of the immigrants is very satisfactory, and indentured labour is now being replaced by free labour, which is being attracted.



The Egyptian Plough, made at Mirpurkhas at a cost of Rs.5.



Fowler's Disc Steam Plough at work near Pusa.

The Indian Government has the intention of entering upon sugar-cane growing on a large scale in Assam, with the object of showing that it can be carried on on a commercial basis. Once this is proved, the Government will, no doubt, be ready to hand the concern over to a business concern. The Tea Planters' Association has stipulated that labour for the sugar plantation must not be drawn from the tea gardens; and in any lease of land granted for other

plantations (rubber, cotton) a clause is inserted to the effect that there shall be no interference with the labour supply of the tea planters.

Coffee is grown in Madras, Coorg, and Mysore.

Tobacco. Tobacco is a crop of great importance. In Southern India a superior leaf is grown, whilst Bengal supplies coarse leaf. Foreign manufacturers are on the point of establishing themselves in India. The French Government sends buyers to Burma yearly.

Cigarette smoking has extended rapidly amongst the natives, and is another sign of the increasing spending power of the people. The Indians do not only smoke extensively, but have an objectionable habit of chewing. They chew, however, not tobacco, but the betel nut, wrapped up in the betel leaf and mixed with lime. The spitting of red saliva as a result of the chewing of this mixture is most objectionable. Indians of all classes seem to have taken it up. I well remember travelling by train, on two occasions, in first-class compartments with gentlemen who passed away the time by chewing betel nut. The lime has a very injurious effect on the teeth.

Potatoes. Potatoes grow well in some parts of India; the best are probably to be found in Assam, and considering the shipping facilities from Calcutta it is surprising that an export trade in new potatoes has not been built up. New potatoes from Assam could be placed on the London market within four weeks of being gathered. They could be delivered in Europe even at Christmas. Strange to say, large quantities of potatoes are imported from Italy into India.

Fruits. The variety grown in India is enormous. Apples do well in the submontane regions only. The Department of Agriculture in the North-Western Provinces has done a great deal to raise the quality of fruit, especially of peaches, and the latter fruit is sent in commercial quantities from Peshawar to the big cities of India. Grapes have been introduced into Sind by the Department of Agriculture and are sold at ridiculously low prices, owing to the absence of demand.

Lac. Lac is an incrustation formed by an insect on certain trees, "a kind of acacia." The natives use the lac with great skill in the manufacture of boxes and ornaments.

Rubber. Rubber trees are planted in Assam, Burma, and South Madras. I visited the Rungia Estate in Assam, where cotton was grown at the same time. A rubber tree grows wild in many forests of India, but it only yields once.

Forests. These are of vast dimensions in India; the Forest Department has about 150,000 square miles under its charge. These play an important part as the head works of nature's irrigation scheme. The net revenue from the forests is about £800,000 per annum, obtained from royalties, sale of timber and other produce, and permits for grazing. Teak is the most valuable of the many different kinds of trees in India.

Famines.

The improved means of communication, the development of railways, and the increasing irrigation works have made famine, as it used to devastate the country, practically a thing of the past. Scarcity does arise, but it is mostly from the difficulty of finding fodder for his cattle that the farmer suffers. On account of its bulk fodder is difficult to transport, and the ryot is therefore compelled to part with his cattle at ridiculously low prices. The Government has had considerable experience in dealing with famine situations, and is very liberal in remitting assessment.

Intelligent Cultivators.

Sir John Strachey says in his work, "India: Its Administration and Progress," that the agricultural classes are certainly not inferior in intelligence to the peasants of many of the countries of Europe, and my own experience certainly confirms this view. The fact is that



The "Rajah" Plough, sold by Volkart Bros., Lyallpur, at Rs.25.

when a real improvement in agricultural implements has been introduced, the Indian ryot readily adopts it.

Introduction of Improved Implements.

This is proved by the large and ever-increasing number of improved ploughs that are being sold by the Agricultural Department, as well as by commercial firms; for instance, Volkart Bros., the well-known Indian cotton export firm, are selling increasing quantities of iron "Rajah" ploughs in the north of India, and I have seen American reapers handled extraordinarily well by Indians. Generally, the large agricultural implements are too expensive for the ordinary small holder to purchase, but the Co-operative Credit Societies might do much to introduce improved agricultural machinery.

The Government of Bombay has now three Bajac ploughs at work, which are hired out to cultivators. The demand for them is very great. The Bajac plough, which is worked by bullocks, goes into the soil to a depth of 15 to 16 inches. The object of this deep ploughing is the eradication of the deep-growing weeds, which in many parts of India make waste land of vast stretches of country.

**Low Yields
per Acre.**

In spite of the fertility of the soil the production per acre in India is not nearly so high as it is in other countries. Thus whilst in India the average yield per acre of cotton is about 100lbs. of lint, in the United States of America it is about 250lbs. The same proportionately low production applies to wheat.

As regards cotton, it must be remembered that in sowing, cotton seed is frequently mixed with oil and other seeds, and that conse-



Converting cow dung into fuel.

quently the yield of cotton does not represent anything like an acre of ground sown with cotton only; nevertheless, much larger yields could be obtained, even with the mixture of seeds, if better cotton seed were sown and more intensive methods of cultivation adopted. The withdrawal from the land of large quantities of manure which is used as fuel must make an enormous reduction in the productive power of the soil. It is true the people are suffering from want of fuel, and manure prepared in the way shown in the illustration serves this purpose well. Another reason for the small yield is the increasing exportation of oil seed. The more economic method would be to extract the oil from the seed in India, retaining the cake for food and manure. A beginning has been made with the crushing of oil seed by modern machinery in the country, and it is to be hoped that this industry will extend and that the exports of oil seed, which have largely increased during recent years, will be reduced.

**Agricultural
Loans.**

As in almost all agricultural countries, so in India, the small cultivators work with borrowed capital, which is supplied in small sums. In India this capital is supplied by the money-lender of the village, his charges varying generally from $1\frac{1}{2}$ per cent. to 2 per cent. per month. Some cultivators told me that in extreme cases they might be charged 6 per cent. per month, but then they said it would be a "fair gamble" and that the money-lender might not get his money back. These rates refer to small loans, but sums of about Rs. 1,000 are advanced at 1 per cent. per month. It is the ease with which the ryot can obtain these loans which prompts him to apply to the money-lender rather than to the Government, which also advances money to the ryot and at the same time encourages the formation of co-operative credit societies, which it supervises.

The Government loans are known as "Takavi," and "Takavi." are made for the purpose of improving the land, by which is understood, anything that adds to the letting value of the land; and, further, for the purpose of relieving distress and for the purchase of seed and cattle. The Government charges $6\frac{1}{4}$ per cent. per annum = 1 anna per Rupee, but the interest must be paid punctually, and repayment must be made at stated periods. In theory, this system seems very advantageous, but in practice only a moderate use is made of it. On March 31st, 1912, a sum of £2,447,659 was outstanding on account of Takavi, almost £900,000 being taken up in the Bombay Presidency, £660,591 in the United Provinces, and £324,683 in Madras. In the other provinces the amounts were trifling.

The main reason for the preference shown to money-lenders is that the ryot, who cannot read or write, is forced into paying secret commissions to native Indian officials when receiving Takavi. I had several cases of this kind brought to my notice, and every European official in India is aware of the practice. It is a common saying that an Indian never handles any money without securing some of it for himself, and the excuse "it is the custom," which is so frequently heard in India, is the only explanation offered. In Sind I travelled with a Deputy-Collector, an Indian, and he explained to me that the clerk who pays the Takavi money generally receives one anna per rupee as "backsheesh" from the ryot, and he argued that the latter gets the advantage, because the same official will not be exacting when he measures the land that is under cultivation for assessment purposes. In the Central Provinces I cross-examined some cultivators on the subject, and much to the astonishment of the Government official present, we were supplied with the name of the Indian official and the exact amount he had demanded and received. Rs. 25 were paid as commission on Takavi advanced for the construction of a well which I believe cost Rs. 300. A similar case came to my notice in Madras. In short, the taking of bribes is quite general. One European official told me that when distributing money during the famines he had to handle the cash himself, as he found it quite impossible to entrust this work to lower officials.

This secret commission is not paid by the cultivators who have had the benefit of school education, but their number is small.

Before a cultivator gets "Takavi" several application forms have to be filled up, and generally a considerable delay occurs before he gets the money. If he wants the money for buying seed, the sowing season may be past before it reaches him. When I have asked the peasants why they did not make more use of Takavi I have generally received the following answers:—

- (1) Payment of "backsheesh" puts up the cost almost as high as we get the loan from the money-lender.
- (2) The money-lender is not as exacting; he will wait a little, or even increase the loan.
- (3) Loans from Government must be used for the specific purpose for which the application has been made, not so in case of loans made by the money-lender.

**Seed on
Credit.**

I am convinced that the supply of good seed is so important that the Government should not insist on formalities, such as filling up of schedules, but it should sell the seed on exactly the same terms as the dealer does, namely, allowing credit for seed until the crop has been harvested. This is done as regards cotton by the Egyptian Government; the seed is paid for after the harvest. The farmers in one village told me they obtained 2 maunds of seed from the dealer, against which they handed him, after the crop, one maund of cotton. According to the peasants' own statement, they would use 24lbs. per acre of cotton seed purchased in the village, against 8lbs. per acre as supplied by the Department of Agriculture; in other words the germinating power is very defective in seed that has been stored by the dealer in a haphazard way. If we further consider that such village seed is often a mixture of various kinds, the need for a liberal distribution of Government seed becomes apparent. But as the cultivator has to pay to the Government hard cash on delivery of seed, and is not accustomed to keep cash on hand (he does not need much, as most of his requirements are bartered), he goes for seed to the village dealer with whom he has a running account, although he knows it is not equal to Government seed. It is more easily obtained, and moreover "it is the custom."

CO-OPERATIVE SOCIETIES.

The close connection which should exist in India between agriculture and co-operation was recognised by the Government towards the end of the last century, and it is now generally realised that no agricultural improvement, on a large scale, can be carried out amongst so vast a population of small holders as there is in India, without the aid of co-operation.

The aims of the Act of 1904 are :—

To encourage thrift, self-help, and co-operation among agriculturists, artisans, and persons of limited means. The Act applies to any society which has as its object the promotion of economic interests of its members in accordance with co-operative principles, or to any society established with the object of facilitating the operations of such a society.

The main provisions of the Act are :—

(1) That any ten persons living in the same village or town or belonging to the same class or caste may be registered as a Co-operative Society for the encouragement of thrift and self-help among the members.

(2) The main business of a society is to raise funds by deposits from members and loans from non-members, Government and other Co-operative Societies, and to distribute money thus obtained by way of loans to members, or, with the special permission of the Registrar, to other Co-operative Credit Societies.

(3) The organisation and control of Co-operative Credit Societies in every Presidency are put under the charge of a special Government officer called the Registrar of Co-operative Credit Societies.

(4) The accounts of every society are to be audited by the Registrar or by a member of his staff called the Auditor of Co-operative Credit Societies.

(5) The liability of a member of a society is to be unlimited in the case of a rural society.

(6) No dividends are to be paid on the profits of a rural society, but the profits are to be carried at the end of the year to the Reserve Fund, although when this fund has grown beyond certain limits fixed under the by-laws, a bonus might be distributed to the members.

(7) In the case of urban societies no dividend is payable until one-fourth of the profits in a year are carried to the Reserve Fund.

The societies are divided into those with limited and those with unlimited liability. The principle of unlimited liability has not the same fear for the Indian cultivator as for the European, for in his family life he has been trained to share prosperity and adversity with the rest of his relations.

In each province Registrars are appointed, generally out of the ranks of the Indian Civil Service, and their work is to carry out the duties laid down by the Act and to encourage the spread of the co-operative movement.

The societies registered under the Act have hitherto been classed as "central," "urban," and "rural," the first class including those societies which lend to other societies only.

The following table shows the distribution of societies by provinces at the end of 1911-12, and gives also some further information as to the development of the three classes of societies :—

	Central.			Urban.			Rural.		
	No. of Societies.	Total Membership.	Working Capital.	No. of Societies.	Total Membership.	Working Capital.	No. of Societies.	Total Membership.	Working Capital.
			£			£			£
Madras	9	643	208,487	47	13,527	48,864	916	51,986	240,231
Bombay†	9	3,611	83,192	75	6,361	34,260	284	19,247	96,475
Bengal	7	236	20,050	61	9,557	55,677	875	28,776	98,118
Bihar and Orissa	8	414	15,659	39	1,725	3,968	491	25,482	40,714
United Provinces	31	2,329	134,802	174	28,459	161,895	1,741	68,981	182,153
Punjab	26	1,274	105,200	26	2,137	7,480	1,717	89,758	375,448
Burma	3	1,129	93,185	37	2,150	26,921	691	16,821	123,469
Assam	1	74	6,073	16	1,829	12,838	125	7,855	13,706
C. Prov. and Berar	25	1,468	37,610	20	1,152	5,383	540	9,516	25,246
Coorg	—	—	—	—	—	—	22	2,179	5,253
Ajmer	1	183	14,007	—	—	—	160	4,259	14,463
Mysore§	1	42	2,844	47	6,801	17,838	63	2,200	3,560
Totals—									
1912†	120	11,361	718,266	495	67,097	357,286	7,562	324,860	1,215,271
1911	60	5,724	334,431	415	69,399	309,425	4,957	238,978	734,591
1910	32	3,740	157,122	321	61,398	244,906	3,145	165,560	443,603
1909	15	1,194	67,140	227	66,544	218,258	1,766	117,151	272,450
1908	7	230	15,454	149	55,525	133,939	1,201	93,173	144,408
1907	14	2,761	*	89	33,599	*	743	54,983	*
1906	9	1,745	*	37	5,914	*	237	20,970	*

* Figures not available.

† Excluding Mysore.

‡ Excluding Sind, where there were in 1912 seven societies, with 624 members and a working capital of £1,233.

§ Figures for 1911. Details for 1912 are not available, but during the last year the total number of societies rose to 208, with 13,148 members, and a working capital of £45,021. In Baroda there were at the end of the decade 122 societies, with 2,815 members, and a working capital of over £13,000.

I give an extract dealing with this subject from a Government Blue Book :—

“ A matter to which special attention has been directed is the combination of the efforts of the co-operative and agricultural departments for the development of agriculture. Co-operative work has in many places been brought into contact with that of agricultural associations, seed societies of a co-operative character have been started, and in many other ways the desired combination has already been brought into play.

“ Satisfactory features of the general development of the co-operative movement in India have been that only a small proportion of the capital of the societies has been advanced by the State, that the purposes to which loans have been applied have been almost entirely productive, and that loans, generally speaking, have been punctually repaid. The rates of interest charged vary, but are considerably lower than those charged by local money-lenders ; it is estimated that, at a low computation, the agriculturists of India are saved £100,000 in interest charges for every £1,000,000 lent out by co-operative societies.

“ The provincial Registrars have hitherto been officials, generally members of the Indian Civil Service ; but, as will be gathered from what has already been said, the part played by the State has been confined, as far as possible, to the encouragement of societies in their initial stages. Besides the Registrars, a staff of inspectors, auditors, and clerks, varying in strength in the different provinces, is entertained by Government, and the latest conference of Registrars expressed the view that it is undesirable at present to relax the Government control over the auditing and inspecting staff. But progress has been made, as has already been noticed, in the decentralisation of supervisory functions, and the Government staff is already outnumbered in the United Provinces and the Central Provinces by the audit and controlling staff entertained by the societies themselves.”

The only province in which the co-operative movement has failed is the North-western Frontier Province.

There is probably no province where the organisation of the co-operative movement has been so successfully utilised in the furtherance of agriculture as in the Central Provinces. Special mention of the movement will be made in the description of the separate provinces.

THE CASTE SYSTEM.

The *Imperial Gazetteer* of India, describing the principle of the Caste System, says that "birth determines irrevocably the whole course of a man's social and domestic relations, and he must through life eat, drink, dress, marry, and give in marriage, in accordance with the usages of the community into which he was born."

The same authority defines caste as a "collection of families or groups of families, bearing a common name, which usually denotes, or is associated with, a specific occupation, claiming common descent from a mythical ancestor, human or divine, preferring to follow the same calling and regarded by those who are competent to give an opinion as forming a single homogeneous community." But time and western influence have considerably weakened the caste system, and one may say that members of one caste are now found in almost every occupation. Nevertheless, there are distinct castes, such as weavers, agriculturists, carpenters, and all kinds of trades have their own caste.

Whilst in Europe social distinctions are mainly due to the possession or non-possession of wealth, and little to intellectual accomplishments, in the East the latter, especially as regards religious matters, are the qualities which command a high social position and are the aim and happiness of the Hindu. Although the Mohammedan religion, as such, does not acknowledge the caste system, still in India, through the influence of Hinduism, the tendency to make class distinctions amongst Mohammedans is distinctly observable. There are undoubtedly many disadvantages in a system which enforces on a person the occupation that must be followed through life, but there is also an advantage in the inherited skill descending from parents to children. A caste may be regarded as a strong trade union, supported by firm religious conviction. The great economic disadvantage resulting from the religions, both Hindu and Mahommedan, is that women of the better castes are prevented from earning their livelihood in any place where male operatives are also at work. Another drawback that arises from caste and religion is that men of different castes will seldom work together. For instance, a person of one caste working in a weaving shed will not handle the shuttle that has been used by a person of a lower caste, unless it has been thoroughly cleansed.

A Hindu family includes not only husband, wife, and children, but almost all who have any claim to blood relationship. These all live together, sharing prosperity and adversity, and looking to the head of the family for guidance. Under the Mohammedan law, real estate and other property are divided up on the death of the owner. The Mohammedans have also the system of joint family, but the bond of union is not so complete as amongst the Hindus. Railway travelling has undoubtedly been to a great extent responsible for the weakening of the Caste System. Indians are fond of travelling, and, owing to the long distances, they are forced to eat and drink in the presence of people of different castes, and this they would never do before the advent of railways.

THE VILLAGE SYSTEMS.

As already mentioned, there are 730,000 villages. Life in these villages is remarkable. Sir Charles Metcalfe says: "The village communities are little republics, having nearly everything they can want within themselves; and, almost independent of foreign relations, they seem to last when nothing else lasts, dynasty after dynasty tumbles down, revolution succeeds revolution: Hindu, Pathan, Moghul, Mahratta, Sikh, English, are all masters in turn, but the village community remains the same."

I am led to the conclusion, however, from many conversations with leading officials that the village system, like the caste system, is in a state of change. Formerly some villages were entirely self-supporting, and this is the case even to-day, but it is gradually becoming evident to the people that, through improved means of communication, largely the result of railway extensions, it pays them better to grow certain crops and to import others. The village system is still strong in Burma, the Punjab, and perhaps also Madras. The villages are frequently walled round, and the people live as in a fortress. Outside the compound is a common grazing land for the cattle.

There are two kinds of villages, the Ryotwari and the Zemindari.

Ryotwari village. In the former villages there is a number of small holders who usually cultivate the land themselves, but sometimes let it out to tenants. The holdings are separate units, and not shares of a whole belonging to all. Each holder acts for himself, and the only common bonds are those of locality and subjection to the headman, as well as the services of the artisans and hirelings. This form of village is universal in Bombay, Madras, Assam, and Burma.

In each Ryotwari village there is an official headman. He exercises petty legislative powers, and acts as arbitrator and civil judge. He has no responsibility for the revenue, beyond that of his own holding. His position is mostly hereditary.

Zemindari System. The other system is the landlord village, or Zemindari. The village in this case is owned by an individual, or by a family. The owners rarely cultivate the land themselves. The land is cultivated generally by a subordinate body of tenants, who pay rent to the landlord. The landlord village system prevails in the United Provinces of Agra and Oudh, Bengal, the Punjab and the Central Provinces. In the Punjab and the United Provinces the present tendency is for co-sharers to divide their responsibilities, and become directly responsible to Government for their separate shares.

In the landlord villages there is a council of village heads called the "punchayet" and the chairman of this is called the "lumbardar." He is directly responsible for the revenue of the village.

"Patwari." In each village there is also an accountant, or "patwari." He has to keep the village accounts of amounts received for revenue payments, and of rent payments by tenants, &c. He keeps the village maps, field registers and other records of

property. It is he who fills up the statistical returns of the crops sown and harvested, the number of cattle, &c. The "patwari" is well informed on everything that goes on in the village and has to report any unusual occurrence to the district officer. Each village has also a watchman ("chowkidar").

The money-lender, who is usually also a wholesale grain merchant, is a very important member of the village community. The services of the artisan are very often paid for in kind, and the money-lender performs the important function of exchanging the different products.

The following opinion of the money-lender is expressed by a high official of the Government :—

"A great number of the agricultural community appear to have a kind of running account with the 'mahajan'; he advances them seed, giving one seer less than the market price. In other instances the advance is made at seed time on the 'sawai' principle, which means a return at harvest of one-fourth more than the quantity borrowed at seed time. He lends money, moreover, for the inevitable marriage and for the inevitable lawsuit. When the tenant falls on evil days, he would advance him rent to save him from ejectment. He is, in fact, at all times, the resource to which the needy agriculturist goes for relief; and the consequence is that a large proportion of the cultivating community is seldom free from the mahajan's influence. When the crops are reaped, the greater portion finds its way to his granary; the tenant retains a share for his immediate use, which is seldom sufficient for the consumption of his household until the following seed time. Long before the next harvest approaches he has, as a rule, to have recourse to the mahajan. The system is not without its advantages in hard times; it is to the interest of the creditor as well as the debtor that the latter should live; there is a community of interest which secures him from starvation."

Sir F. H. Nicholson says about the money-lender: "On this subject there are two opinions, one of which regards him as on the whole rather beneficent and friendly, as a sort of partner with the ryot, supplying the needs of the latter, maintaining him in times of misfortune. Others, again, regard him as a beast of prey seeking everywhere whom he may devour. The truth, as usual, probably lies near the middle. As society and credit are at present constituted, he fills an absolute gap, and is a rural necessity. On the other hand he is most undoubtedly an expensive and dangerous necessity. He has been found in India from time immemorial."

Simple life. The villager is content with little: the comforts of European life are frequently unknown to him, and consequently he does not feel their absence. His ideal is to attain accomplishments in his religion, and we may therefore say that he aims at things higher than those which the material world can offer. His food, his clothing, and his house are the simplest imaginable; if he has any money to spend beyond that expended on bare necessities, he applies it to clothing and jewellery.

The law of succession.

Amongst the Hindus there are two schools, the "Mitakshara" and the "Dayabhaga." Under the former the whole family constitutes one body, and when one of the family dies the property is taken over by all the remaining members, therefore succession to property amongst Hindu families governed by the Mitakshara law is non-existent, except in the few cases when property is separately held.

Under the Dayabhaga law succession takes place, the whole of the property passing to the male children. If there are none, then it passes to the next of kin.

Amongst the Mohammedans, property is divided among a large number of heirs, which causes the splitting up of land into very small areas.

These systems have their advantages and disadvantages. Among the former are the prevention of the accumulation of wealth in the hands of a few individuals, and the possibility of a large number of persons beginning on their own account. When, however, the land is split up into very small areas, the owner will not be able to feed himself from it, and he is driven to work for somebody else. These very small holdings also necessitate the unnecessary multiplication of agricultural implements, and the small landowner endeavours to fulfil the combined functions of agriculturist, capitalist, and businessman, and naturally he fails. It is only through the establishment of Co-operative Credit Societies that these small holders will learn to cultivate the soil and to dispose of the produce with advantage. Many Indians maintain that it would be more profitable for India to become an industrial State, that the profits from manufacture are higher than those from agriculture, that a manufacturing country is capable of supporting a larger population than an agricultural country, but to my mind the remedy for the present unsatisfactory condition of agriculture lies in the distribution of labour; and Co-operative Credit Societies alone can effect the rescue. The farmer in producing his crops is much in the position of the manufacturer. If our manufacturers of, say, cotton goods, only produced small quantities, they would be at the same disadvantage as the small farmer is now. They would be handicapped in buying their raw material, which one might compare with the seed; they could not sell their small production to the best advantage.

The handicap seriously affects the small holder, who has to apply to the money-lender for means to keep himself alive during the growing season, and to whom he has to mortgage his crop at high rates of interest. The co-operative movement would not only give the small holder financial benefit, but it would teach him the virtue of straightforwardness in his transactions.

LAND REVENUE AND TENURE.

In the fuller description of cotton growing in the various provinces, mention will be made of the system of land revenue and tenure in vogue in each province, but the following remarks will explain the principles and the method which, in a general way, underlie the various systems in force. There are a great many exceptions to this general statement, but, without it, I fear the conditions will not be understood.

The land revenue of modern India is a form of public income derived from the immemorial custom of the country. In its primary shape it was that portion of the cultivator's grain-heap which the State annexed for the public use, and this crude method of realising the bulk of the State income appears to have been practically the only method in force throughout the greater part of India until the sixteenth century. Revenue is indeed still levied in this manner in many of the native states, and there are large tracts where rents are so taken by landlords. Under the Mughal rule, cash payments—fixed, when possible, for a period of years—were to a large extent substituted for payment in kind; but under later rulers the collection of land revenue became practically little more than a disorganised scramble for the greatest amount of income that could be wrung from the land. As the several provinces came under British control, their assessments were gradually reduced to order, the systems selected being at first tentatively adopted according to the varying circumstances of the different tracts, and becoming more and more crystallised as time went on.

Zemindari and Ryotwari Tenures. As described under the title Village Systems, we differentiate mainly between—

Zemindari tenure	..	Landlord system universal in the United Provinces, Bengal, Punjab, and Central Provinces.
and		
Ryotwari tenure	..	Individual occupant system, universal in Bombay, Madras, Assam, and Burma.

In the former case the landlord is responsible for the assessment, in the latter the occupant.

Permanent and Temporary Settlements. A further distinction is where the assessment is made either permanently, or for a fixed period of years. As far back as 1793 the assessment in Bengal was declared to be fixed in perpetuity. Other permanent settlements were made in the Benares district and in certain portions of the Madras Presidency. Altogether one-third of the area of British India is on a permanent settlement. In the remaining areas the assessments are fixed for a period of years, the ordinary term being 30 years in Bombay, Madras, and the United Provinces, and 20 years in the Punjab, Central Provinces, Burma, and Assam. The following table roughly indicates the extent to which the different systems prevail :—

Figures in Thousands of Acres, omitting 000.

Province:	Ryotwari (Peasant Proprietors).	Zemindari (Individual Proprietors or Village Communities).		Total
		Permanently settled.	Temporarily settled.	
Burma	108,799	—	—	108,799
Assam	25,916	3,930	1,459	31,306
Bengal	—	38,789	10,780	49,569
Bihar and Orissa ..	—	41,452	11,760	53,212
United Provinces of Agra and Oudh ..	—	7,541	60,793	68,334
Punjab	—	—	62,215	62,215
North-west Frontier Province	—	—	8,438	8,438
Bombay	44,876	—	3,754	48,629
Sind	30,257	—	—	30,257
Central Provinces ..	1,837	—	40,639	42,476
Berar.....	11,327	—	—	11,327
Madras	61,577	29,179	—	90,756
Ajmer-Merwara	—	974	797	1,771
Coorg and Manpur	1,044	—	—	1,044
Total	285,633	121,865	200,635	608,133

Method of Assessment. Each province has a land record staff, which keeps the village maps and records up to date, preserves the boundary marks, and generally looks after the settlement. The duties of the settlement officer entail a minor personal inspection from village to village through large tracts of country. He classifies the land according to its fertility, and the revenue is levied according to this classification. Under the Zemindari system the demand is assessed on the village or estate, and is a definite sum either in perpetuity, or for a fixed term of years, during which the whole of any increased profits due to extension of cultivation, enhancement of rents, &c., is enjoyed by the individual landlord, or proprietary body, but under the Ryotwari system the assessment is on each field, as marked on the village map. The assessment takes the form of revenue rates for different classes of land. The Government now takes a very much lower share than was customary in pre-British days. Owing partly to the lack of capital amongst the agricultural population, the land revenue is not generally collected in one payment, but in instalments, the dates and amounts being fixed to meet local circumstances. The Government cannot be said to be over strict, if one considers that from 1899 to 1900 the collection of revenue to the amount of £1,376,000 was suspended in the districts affected by famine, and at the conclusion of the famine in 1902 no less than £1,321,000 were entirely remitted.

In 1908 a sum of over £500,000 was remitted in the United Provinces. It is generally recognised that total relief is given when the crop is less than a quarter of the normal, and that no suspended revenue is collected until a fair harvest has been gathered. The rates of revenue vary with the productive power of the soil, the climate and irrigation, and facilities for marketing the produce. In Madras and Sind the land revenue rates include the charges for irrigation.

IRRIGATION.

Although the question of irrigation will be dealt with in the description of the various provinces, yet a general statement will not be out of place.

Practically the whole of the north-western part of India only receives rain in small quantities and at unevenly distributed periods. It is therefore only by means of artificial irrigation that agriculture can flourish there. Other parts of India, *e.g.*, Madras, Bombay, Central Provinces, have also some means of artificially watering the growing crops. The whole of the larger and more important works of irrigation have come into being under British rule. Too much praise cannot be bestowed on the Government of India for the marvellous irrigation works that have been constructed during the last 25 years.



Lifting water by means of baskets.

There are three great classes of irrigation works: (1) Lifts, (2) storage, (3) river. These are represented by wells, tanks, reservoirs, and canals.

Lift. Purely lift irrigation works are of a minor character, and are not owned, or maintained, by the State. Private enterprise in well construction is extensively encouraged by agricultural loans, and by a liberal land assessment. The number of wells has very largely increased during the last few years, especially in Madras, owing to the expansion of the cultivation of Cambodia cotton. There is also a large increase in the United Provinces.

Tanks. Tanks, or storage works, differ considerably in size, ranging from great lakes, formed by the construction of dams across the beds of rivers which flow irregularly, to the small village tank, or reservoir, to be found near almost every village in southern India. Some of these reservoirs irrigate less than 10 acres. Tank irrigation was largely begun when the country was under native rule, and the maintenance of these tanks either wholly, or in part, is

new undertaken by the State. Many small tanks are constructed, maintained, and owned by private individuals, and some of these have only a small supply of water in years of drought.

Canals. The most important irrigation work undertaken by the State is that connected with the rivers and canals. This work is, generally speaking, so extensive that it can only be engineered and efficiently maintained by the State. There are, however, some private canals in existence. The great State canals must be divided into two classes: "perennial" and "inundation." Most of the canals belong to the former class, having a supply of water all the year round. The inundation canals receive water only during the flood season. They are situated mostly in the Indus valley.



A WELL IN THE BROACH DISTRICT.

(Whilst the bullocks walk down the incline the bucket ascends; no water is lifted whilst the bullocks walk up the hill.)

The Public Works Department looks after the construction and maintenance of the canal and tank irrigation works. It divides irrigation works into two classes—major, and minor, works. Major works are divided into:—

(a) *Productive* public works, the capital cost of which is usually met by money borrowed specially for the purpose.

(b) *Protective* works, *i.e.*, such works as are a protection against famine, the capital cost of which is provided out of the revenue.

Minor works are constructed out of current revenue, and may be said to consist of irrigation systems that are not of first rate importance. Some of them are old works constructed by former rulers, others are village works, originally constructed by private or communal effort,

which the State has had to take over owing to disputes, or inability to maintain efficiently.

“Productive” public works, are expected to yield, within 10 years of their completion, sufficient revenue to pay working expenses, and the interest on the capital expended on their construction. No project is sanctioned unless it can be shown that these conditions can be fulfilled.

“Protective” works are undertaken with the main object of averting famine. Naturally, much less regard is given to the works as a remunerative investment than is the case in the construction of “productive” works. It must be noted, however, that “protective” works may, and do, in most cases, bring about a larger income to the Government in the shape of increased land assessment.

The table on the opposite page shows the mileage of canals in operation, and the areas irrigated in British India, by State works for each year from 1902 to 1912. with the total capital expenditure, and the percentage of net revenue, as shown in the department reports.

The estimated value of the crops grown, in 1910/11, on the lands irrigated by the works included in the above table was over £37,000,000.

The revenue receipts from Government irrigation works are derived almost entirely from the charges made for water, which depend, *not* on the volume of water supplied, but on the kind of crops cultivated, and the areas actually irrigated. In Madras, Sind, and parts of other provinces, the charge for water forms part of the land revenue assessment, and thus £1,000,000 sterling is annually paid out of land revenue to the Irrigation Department. In the Punjab, the United Provinces and Bengal, the charge for water is generally distinct from the land revenue assessment. In Bengal a system of extended water leases exists, but in all other cases revenue from water supply fluctuates according to the fields which have actually been irrigated. The average rate realised on major works from irrigation of all kinds is Rs. $3\frac{1}{2}$ per acre.

Navigation Canals.

Comparatively few canals are used both for irrigation and navigation, in fact it seems that the two purposes cannot be fulfilled simultaneously in India. Altogether some 3,500 miles of canals are navigable in India, but without bringing any funds into the coffers of the State.

Financial Results.

The financial results of the irrigation canals are, on the other hand, very satisfactory. The percentage of net revenue on the total capital outlay on all canals (irrigation and navigation) has during the last 10 years always been above six per cent. The figures of capital outlay (for 1911-12, £41,510,000) include expenditure on works still under construction, and if net revenue on capital outlay on works in operation is taken, we get a return of

$8\frac{1}{4}$ per cent. for “productive” works, and
1 per cent. for “protective” works.

Leaving some of the earlier irrigation works out of account we get a return of over 10 per cent. on the capital expended on the productive works. Up to 1912 these had contributed £25,000,000 to the general

revenue, after deducting interest charges. The earlier irrigation works of the productive type, which may be classed as unsuccessful, have caused a monetary loss to the State of £7,000,000, though, of course, they have been of indirect benefit. The canals of the Punjab are the most remunerative, averaging for 1913 about 16 per cent. interest on the expenditure. A fuller account of the Punjab irrigation works will be given in the chapter dealing with the Punjab.

PART II.

Historical Reference to Cotton.

World's Cotton Supply and Demand.

Statistical Returns of Indian Cotton Crop.

Damping of Ginned Cotton.

Damping of Seed (unginned) Cotton.

Handling and Marketing of Indian Cotton.

Part II.

HISTORICAL REFERENCE TO COTTON IN INDIA.

Whilst cotton was introduced into the United States of America by Europeans, and has only been cultivated there on a large scale during the last hundred years, the cotton plant is indigenous to India, and we may look upon India not only as the land of origin of cotton cultivation, but also as the land in which cotton was first manufactured into cloth. In ancient Indian literature we find only few references to the cotton plant, but in the "Laws of Manu" the sacrificial thread of the Brahmins, which serves as the symbol of the Indian Trinity, is spoken of. This "sacrificial thread," which is worn to the present time, had to be made of cotton. We have evidence from the works of other writers, centuries before the Christian era, that cotton was also woven into cloth. Herodotus, who lived in the fifth century before Christ, writing of India says: "They possess likewise a kind of plant which, instead of fruit, produces wool of a finer and better quality than that of sheep; of this the Indians make their clothes."

Later on, the historians who accompanied Alexander the Great to India describe the cotton plant, and Theophrastus mentions "a tree from which the Indians make garments and whose leaves are like those of the mulberry tree, whilst the whole plant is similar to the wild rose tree; these plants are grown in rows resembling vines." Later references are made by Strabo and Pliny, and an authority of the first Christian century mentions the export of cotton to the East Coast of Africa, and differentiates between a coarse and a fine quality of cloth. It is stated that India had practically the monopoly in the manufacture of cotton goods between the years 1500 B.C. and 1500 A.D. During the Roman era and the Middle Ages India exported cotton to Europe, where it was considered a luxury. During the Middle Ages, Arabian merchants spoke of the fine textures which could be bought there, and Marco Polo mentions that the finest and most beautiful textures were woven on the Coromandel Coast. From India the cultivation of cotton proceeded to China. The Portuguese discoverers of India admired the magnificently coloured turbans which they found there, and later on the British started factories amongst the weavers of Calicut, Masulipatam and the Hoogly. The British first landed at the town of Calicut. From the name of the town the word calico is derived.

Explorers of later periods are full of praise for the wonderful muslins of Dacca. They mention that the texture appeared like spiders' webs, and that when bleaching on the grass it was "invisible owing to the fineness." In 1660, Tavernier writes in his diary with regard to Indian cotton cloth: "If a person puts such garments on his body, it is visible just as if he were naked. The merchants are not allowed to buy this cloth. All of it must be delivered into the hands of the King, who has garments made of it for the inmates of his harem and the

wives of the noblemen, as the King and the noblemen find great pleasure in seeing their women attired in this wonderful texture." Even in the eighteenth century Indian spinning was so much superior to that of Lancashire that weavers of Blackburn and Bolton are said to have imported large quantities for the purpose of weaving the yarn on their looms. What a difference to-day, when India is the principal market for Lancashire cotton goods! More than £30,000,000 worth of cotton yarn and cloth are imported into India from Lancashire every year, and to-day we find in India cotton mills built like those in Lancashire. The change in conditions was brought about by the inventions of Hargreaves, Crompton, and Arkwright at the end of the eighteenth century.

At the commencement of last century England's importation of cotton from India was about 15,000 bales of 400lbs. and the following figures show what remarkable fluctuations took place in the import during the first half of the century :—

1810	1818	1821	1841	1848	1857
79,000	247,000	20,000	278,000	49,000	680,000 bales of 400lbs.

The East India Company endeavoured to promote the cultivation of cotton in India, and there is evidence that seed was brought from North America, Brazil, and Egypt; as far back as 1788 selected seed was distributed among the natives, and from 1829 to 1841, large amounts of money were given in the shape of prizes for superior cotton raised in India. In 1849 the East India Company induced 10 experienced cotton planters from the Southern States of North America to introduce the cultivation of New Orleans cotton into Madras and Bengal. Only in the South of Madras and Dharwar were these efforts crowned with success. About 1852 a project was elaborated in England to provide, within five years, a sum of £20,000,000 for improving and extending the cultivation of cotton in India, but the Mutiny and the lack of efficient transport facilities were responsible for the failure of this project. Indian cotton remained of short staple and had little reputation in Lancashire, even at the time of the cotton famine during the American Civil War, "O Lord, send more cotton, but preserve us from Surat," was often repeated in prayer meetings during those heart-rending times in Lancashire. Still, during the Civil War from 1861-65, Indian cotton was largely in demand in all countries, and it began to be recognised that it was the only country which could make up for the shortage of supply from America. Efforts were made by the Government and private individuals to extend cotton cultivation in India; in 1863, for instance, the Government sent a special expert to Bombay and from there to the Central Provinces, where he laid out cotton plantations. It is noteworthy that in the same year the Bombay Cotton Frauds Act was passed. This Act was, however, repealed in 1868, as its disadvantages, mainly due to bribery and blackmail, were greater than its advantages. In 1863, the well-known Mr. Sam Platt, of Platt Bros. & Co., Ltd., Oldham, founded the "Cotton Suppliers' Association" whose main attention was devoted to the cultivation of cotton in India. The success of the association was not very great, the efforts to improve the fibre by the introduction of Sea Island and Upland seed failing.

The extension of railways, which took place shortly after the renewed interest in cotton cultivation, and the erection of mills in India, gave a great impetus to the further development of cotton growing in India. In 1902 the Upper India Chamber of Commerce drew attention to the advantages resulting from a more intensive system of cultivation, and in 1904 the British Cotton Growing Association forwarded to Lord Curzon, then Viceroy, a memorandum in which valuable suggestions were made for the further development of the Agricultural Department. In the following years the British Cotton Growing Association undertook, in connection with Messrs. Shaw, Wallace, and Co., two extensive experiments with tree cottons, which failed owing to the prevalence of floods and insect pests. The Association was prevented from devoting further funds to cotton growing in India, as it had been decided to develop the cultivation of cotton in the British possessions in Africa. The Agricultural Department in India, meanwhile, gained in strength and in experience, and in 1905-6 experiments in Sind with Egyptian cotton were successfully carried out. Owing to the failure of the water supply in the canals the experiments could not be extended. In all other provinces experiments with exotic and indigenous cottons were undertaken in the following years by a few agricultural experts who had been sent out from England by the Secretary of State.

**Work of
International
Federation.**

In the autumn of 1909-10 I went to India for the purpose of obtaining the affiliation of the Indian millowners to the International Federation of Master Cotton Spinners' and Manufacturers' Associations,* and whilst there I visited several Government farms in the cotton districts. My report on that visit formed the material for a discussion at the Brussels Congress of the International Federation on the question of the possibilities of extending cotton cultivation in India, and resolutions adopted at that Congress were submitted to two Secretaries of State for India, The Right Hon. Viscount Morley of Blackburn, O.M., on July 27th, and the Most Hon. the Marquess of Crewe, K.G., on November 21st, 1910.

The Committee of the International Federation became more and more impressed with the potentialities of India as a cotton-producing country, and decided in 1911 that I should make a second tour through India. My experiences and impressions of that journey were published in a report, "Cotton in India," and the recommendations made in it were submitted to Lord Crewe on July 1st, 1912.

At the Ninth International Cotton Congress at Scheveningen, various resolutions regarding Indian cotton growing were adopted, and these were submitted to Lord Crewe on July 22nd, 1913; at the same time I was requested to undertake a third tour through the cotton-growing provinces of India.

**Recent
Extension of
Cotton.**

Mr. J. Mackenna, I.C.S., the officiating Agricultural Adviser to the Government of India, submitted in November 1913 to the Board of Agriculture at Coimbatore the following interesting figures illustrating the recent extension of cotton growing in India:—

* I shall refer to this organisation subsequently as the "International Federation."

“The figures for India (excluding Native States) show that while the total cultivated area under all crops has increased during the decade from 205,239,350 acres to 215,981,683 acres, or 5·4 per cent., the area under cotton has, during the same period, increased from 11,104,298 acres to 14,568,189 acres, or 31·4 per cent. The percentage of the total cultivated area devoted to cotton rose, during the decade, from 5·4 to 6·7 per cent. The greatest increases of area under cotton during the decade have been in Bombay and Sind, where the area has increased from 3,048,196 acres in 1902-03 to 4,443,018 acres in 1911-12, or 45·8 per cent. ; the Central Provinces and Berar, where the area has increased from 3,892,030 acres to 4,648,203 acres, or 19·4 per cent. ; Madras, where the increase has been from 1,580,867 acres to 2,675,838 acres, or 69·3 per cent. ; and the Punjab, where the area has increased from 1,041,661 acres to 1,462,500 acres, or 46 per cent. In the Native States the area under cotton increased from 456,228 acres in 1902-03 to 625,694 acres in 1906-07, or 37·1 per cent. The larger recorded increase since 1907-08 is due to the fact that many Native States then for the first time supplied statistics of the cotton crop.”

I may mention that in 1908-09 the Indian cotton crop was 3,816,000 bales, whilst for 1913-14 the Government estimates are 5,201,000 bales, but probably 6,000,000 bales will be reached.

If the efforts of the International Federation have contributed in any degree to this increase, its work in India must be a source of gratification to every member.

COTTON. THE WORLD'S SUPPLY AND DEMAND.

The cotton industry of the world has, during the last ten years, been suffering from a scarcity of raw material. This scarcity has frequently been so pronounced that mills in all parts of the world have been obliged to curtail production at one time or other. For many months past a reduction in the working hours in the cotton mills of several continental countries has been necessary, but although the English Spinners' Federation discussed the advisability of curtailing production, yet owing to a temporary improvement in trade, and the action of certain mills outside the Federation, the percentage of members necessary to bring about organised reduction of working hours was not obtained.

The need for curtailment of production arises primarily from the fear that the world's yearly supply of cotton will not be sufficient to meet the yearly demand, *e.g.*, during last season we were told that the American cotton crop would be about $13\frac{1}{2}$ million bales, whilst it is recognised that $14\frac{1}{2}$ million bales of American cotton are required annually. This probable scarcity caused an increase in the price of the raw material and of the manufactured product, and a falling off in the demand for goods. It must be remembered that by far the vast majority of the people in the world, the poorest, who have no choice but to use cotton clothing, have only a very small fixed amount per annum to expend on clothing, and it makes a great difference to them, in the quantity of clothing they can afford to buy, whether cotton is 6d. or 8d. per pound.

SUPPLY.

What are the possibilities of extending cotton cultivation in the world ?

Africa. At one time the hope was entertained that Africa would solve the problem of supplying the cotton-spinning industry with its ever-increasing requirements, but after ten years' work in that continent it has been proved that, in consequence of the absence of the requisite training of the people, the comparative scarcity of labour, the absence of transport facilities, the necessarily slow development of research work, and of the unwillingness of the people to work longer than is absolutely necessary to keep their few wants supplied, developments in these parts must be slow. Perhaps the next generation will reap the benefit of the present pioneer work. Most valuable work is being carried on, not only by the British Cotton Growing Association, but also by the German, French, Italian, and Portuguese colonial cotton growing associations. The very existence of these associations is a proof of the earnestness with which this question of increasing the supply of cotton is being handled.

America. Cotton planters of the United States of America, and others interested in land, often assure us there is no need to look elsewhere for the supplies to meet the increasing wants of the cotton industry. I would say, in reply to this contention, that it would be unwise for the world's spinners to depend upon one source of supply only, especially when, as in the case of the United

States, there is a climate which, judging from the alarmist reports issued every year, seems to be the most uncertain in the world. Further, the cotton districts in the United States are suffering severely from lack of labour. Several experts who have recently visited the country state that in 1911, when the cotton crop of the United States reached 16 million bales, much more was grown, but that it had to be left to rot in the fields, as there were no people to pick it. Some authorities maintain that wages have increased of late to such an extent that the growing of cotton is becoming unremunerative, and that unless cotton can be sold by the planter at 6d. per pound, which means that the spinners will have to pay considerably more, cotton cultivation in the United States of America will decline. As an example of the recent wages paid in the United States I am able to state that, whilst the "piece rate" for picking in Texas usually began at 50 or 60 cents per 100lbs. of seed cotton, rising later, as the crop became thinner and more difficult to gather, to over 100 cents, during the early part of last season pickers could not be got in Texas below 70 cents, and the 100 cents rate was reached very quickly. If we remember that it takes about 300lbs. of seed cotton to make 100lbs. of lint cotton, the cost of picking works out to 1½d. per pound. Under these conditions, countries outside the sphere of such high wages seem to have an excellent opportunity of competing with the United States of America. Experts seem more and more of the opinion that cotton growing in the United States will only be remunerative in the case of staple cottons, such as are produced in the Mississippi Delta, whose value is much above the ordinary type.

These considerations seem to justify the prevalent assumption that the limit of the cotton crop of the United States has been almost reached. It is true that owing to the excellent organisation of the United States Department of Agriculture the yield per acre is gradually increasing; but if labour cannot be found to harvest the cotton, the full advantage of its activity cannot be realised. So long as no efficient mechanical cotton picker is invented (and so far the results obtained have not been satisfactory), the cotton crop of the United States will probably not far exceed 16 million bales. In the event of an efficient mechanical cotton picker being put on the market, it is doubtful if many planters would be able to purchase it. The tendency in the States is to split up the large plantations into small holdings, and the small farmer has not the capital with which to buy such a machine. We must not leave out of consideration the boll-weevil scourge which is devastating vast stretches of territory. It is stated that in five years time the Sea Island cotton districts will be attacked, and that the farmers there will be forced to grow early maturing varieties of cotton which are largely of short staple. It is for this reason that every effort should be made to complete the irrigation works in the Anglo-Egyptian Sudan. Egypt and the Sudan will be called upon to make up for the shortage that will result in the supply of long-staple cotton, when the Sea Island districts have become a prey to the ravages of the boll-weevil.

The Republics of South America are already suppliers of cotton to a small extent (500,000 bales), and when better means of transportation are established, and the

population increases, it is probable that Brazil and Peru will furnish large quantities of cotton. But for a generation or two, this cannot happen. At present the unsettled financial condition of these Republics prevents development.

Egypt. Egypt is limited in its cotton crop by the comparatively small area that can be irrigated; Lord Kitchener is doing his utmost to reclaim some considerable stretches of waste land, and bring them under irrigation. Egypt now produces about one million bales, of 700lbs., per year, but there has been during the past 10 years a falling off in the yield per acre.

Anglo-Egyptian Sudan. The possibilities in the Anglo-Egyptian Sudan are certainly very great, but it will probably take 15 years at least, for that country to produce half a million bales.

In view of the threatened shortage of long-staple cotton from America the Sudan irrigation scheme in hand should be pressed forward, and money should be liberally supplied for the work.

Asiatic Russia. Asiatic Russia supplies the Russian cotton industry with one million bales of cotton of 500lbs., quite equal in quality to Middling American. The principal cotton-growing districts are Ferghana, Syr Darja, Semiretschenck, Samarkand, and the Transcaspian territory. The danger of the increasing evaporation of moisture from the soil in Turkestan, the lack of transport communications for the importation of fodder and food crops, as well as for the exportation of the cotton crop, and the lack of labour, are the principal reasons why the extension of cotton cultivation in Asiatic Russia is bound to be slow. The average wage of a labourer is 4s. per day; this alone is enough to prevent any large extension.

China and Korea. It is estimated that China and Korea produce about one and a half million bales of cotton of 500lbs., but very little is known as to the possibilities of extension.

The quality produced is very low, and the cotton is adulterated with over 15 per cent. of water and sand. The unsettled political state of China is bound to impede developments there.

Turkey. Turkey produces about 100,000 bales of cotton per annum. Owing to the massacres which have recently taken place in Asia Minor, the country suffers severely from lack of labour, and even if the projected works of irrigation are successfully carried out, it will be a long time before appreciable quantities of cotton can be exported.

India. After considering the possibilities of the extension of cotton cultivation in all these countries, we come to India, which possesses an excellent network of railways, has a hard-working population, 90 per cent. of the 315,000,000 being born agriculturists, and in which cotton has been an important crop from time immemorial. It is true that crops in India are largely dependent on the monsoons, but it is equally true that the climate of India is no less favourable for cotton growing than that of the United States. Besides, the Government has developed a wonderful system of irrigation, especially in the North; and the Indian ryot, taking him as a whole, is a steady, plodding worker, who has begun to appreciate the advantages resulting from an increased income. This is a very

important factor. The Indian ryot has discovered that well-irrigation makes cotton growing profitable; indeed, in Madras and the United Provinces, the number of wells constructed by the cultivators in recent years may be said to represent the savings that have resulted from the increased profits on cotton cultivation. These wells are the best insurance against famine.

DEMAND.

I now come to the question of demand.

It has been said that a demand for cotton goods is one of the first signs of civilisation. Mr. Alexander J. Kusnetzoff, one of the leaders of the Russian cotton industry, stated at the Seventh International Cotton Congress at Brussels (1910) that of the 1,500,000,000 inhabitants of the earth, there are only 500,000,000 completely clothed, whilst 750,000,000 are partly clothed, and 250,000,000 do not possess any clothing whatever, and that in order to provide clothing for the whole of humanity, at least 42,000,000 bales of cotton, or $15\frac{1}{2}$ lbs. for every human being, were annually required.

The world's consumption of cotton has increased from $17\frac{1}{4}$ millions in 1909 to $22\frac{1}{4}$ millions in 1913, *i.e.*, at the rate of one million bales per annum! These figures are based upon the statistics issued by the International Cotton Federation.

Russia has increased its consumption of cotton as follows:—

Consumption.		Consumption.	
	Lbs. (English).		Lbs. (English).
1855	54,195,000	1901	603,371,000
1860	90,325,000	1902	541,950,000
1870	144,520,000	1903	794,860,000
1875	162,585,000	1904	726,213,000
1880	307,105,000	1905	614,210,000
1886	361,300,000	1906	755,117,000
1890	252,910,000	1907	751,504,000
1894	444,399,000	1908	794,860,000

(Half of this cotton is grown in Asiatic Russia.)

The weight of cotton cloths produced on power looms and consumed in India has increased from 536,960,200 lbs. in 1896-97 to 988,027,318 lbs. in 1912-13. The consumption per head of the population in India is equal to 3.63 lbs., or roughly 14 yards. The clothing of the people of India requires annually $3\frac{1}{4}$ million bales of cotton (including waste), but every additional yard used per head of the population represents an increase of about 232,000 bales of 500 lbs. each. The increased prices which the cultivators of India are receiving, not only for their cotton, but also for other produce, are bound to place them in an improved financial position, which will undoubtedly lead to an increased expenditure on clothing.

But besides Russia and India there are other vast countries, such as China, Africa, Central Asia, &c., all of which will demand increasing supplies of cotton clothing.

Consideration must also be given to the fact that cotton has entered into many new uses in Europe. It is in great demand for the

making of motor-car tyre covers, bagging, ropes, aeroplane cloth, &c. ; and, as a result of the discovery of the mercerising process, in the manufacture of certain classes of goods, cotton has replaced silk to a considerable extent. Spinning and weaving machinery has extended to meet the increased demand, and this extension will continue ; but the cotton industry must obtain an annual increase of about 1,000,000 bales of raw material.

As a further example of the growing consumption of cotton by the European countries, I may state that, according to Government figures, the consumption per head of population in Germany has increased as follows :—

1840.....	3 kgms.	} Whilst the figures for the consumption of wool show a decline, the cotton consumption is more than 25 times larger than 70 years ago.
1895.....	5 „	
1900.....	6 „	
1909.....	7 „	
1912.....	7·6 „	

This enormous and ever-increasing demand for raw cotton ensures the cultivator for many years to come a remunerative price for his cotton crop, and not only the Government of India but every other Government is fully justified in encouraging the cultivation of cotton in face of this regularly increasing demand.

It is not yet 20 years since Middling American cotton was 3d. per pound, but for the past few years it has rarely fallen below 6d. per pound.

The demand outside India for the cotton grown there comes principally from Japan and the Continent of Europe ; Lancashire and the United States of America are only small consumers. On the European Continent Indian cottons of superior qualities are being employed more and more to take the place of American cotton, and the statistical compilations of the International Cotton Federation, showing the stocks of cotton in bale on hand in the whole world on March 1st, 1914, indicate the increased use to which Indian cotton has been put during the last year. One may reasonably assume that the size of the stocks of Indian cotton—and in many countries they are twice as big as in previous years—indicates that the consumption of cotton of this class has been much greater than in former years.

Even if Lancashire does not herself use Indian cotton, yet two great advantages accrue to the English cotton industry from the extension of cotton cultivation in India, viz. :—

(1) Every additional bale of cotton raised in India liberates a bale of American cotton, and consequently lessens the demand and price for it. Seeing that this year's crop in India will probably amount to 6,000,000 bales, the boon to the cotton industry as a whole resulting from a crop of these unprecedented dimensions must have been of inestimable value. Had the Indian crop been of normal size, the price of American cotton would undoubtedly have risen to record figures. As it is, the cotton manufacturing industry of the whole world has benefited.

(2) Lancashire's secondary advantage is that by extending cotton cultivation in India by improved methods, especially by

seed selection, the ryot becomes financially better off, the consequence being that he is able to spend more money on his clothing, of which about 90 per cent. is supplied by Lancashire. Indian millowners also derive much advantage from the improved financial position of the ryot.

The International Cotton Federation has at all times urged, in the first instance, the growing of larger quantities of cotton in India. Although the question of quality has been looked upon as a point of secondary importance, yet it is one which would naturally receive attention.

The results achieved in regard to quality in Madras, in the Punjab, in Sind and Gujarat are very promising, for taking these together we have had during last season a crop of some 300,000 bales which are of a quality equal to Middling American, though owing to defective picking and mixing the price obtained has not been as high as it might otherwise have been.

STATISTICAL RETURNS OF INDIAN COTTON CROP.

Crop Forecasts.

The statistical system in India so far as crop returns are concerned is far from satisfactory. For the purpose of estimating the crops in each village a map, on which the various crops are noted each year, is kept by a Recorder, and from this map the total figure of each crop is periodically reported to the Commercial Intelligence Bureau in Calcutta. The ascertained production of a selected plot of one-fifth, or one-tenth, of an acre in each district is taken as an average crop, and the estimated acreage in each district as marked on the map is multiplied by the figure thus obtained. The difference between the calculated figure and the real facts, according to the opinion of those who compile them, varies from 20 to 25 per cent., and it may be said that the result is a "calculated guess." Generally, the figures of the Commercial Intelligence Bureau are too low.

Final Estimate of the Cotton Crop of India.

Provinces and States.	1913-14		1912-13		1911-12	
	Area (acres)	Yield (bales)	Area (acres)	Yield (bales)	Area (acres)	Yield (bales)
Bombay* ..	6,351,000	1,397,000	6,064,000	1,324,000	5,121,000	599,000
C. Provinces and Berar	4,715,000	961,000	4,493,000	910,000	4,648,000	913,000
Madras*	2,593,000	513,000	2,414,000	471,000	2,878,000	335,000
Punjab*	2,053,000	594,000	1,575,000	373,000	1,582,000	241,000
U. Provinces*	1,586,000	484,000	1,158,000	428,000	921,000	251,000
Sind*	332,000	133,000	296,000	123,000	346,000	124,000
Burma.....	288,000	50,000	233,000	46,000	186,000	32,000
Bihar and Orissa† ..	86,000	19,000	92,000	19,000	88,000	19,000
Bengal*	51,000	13,000	51,000	21,000	63,000	25,000
N.W. Frontier	59,000	14,000	56,000	13,000	56,000	12,000
Assam	33,000	12,000	35,000	10,000	36,000	11,000
Ajmer-Merwara ..	57,000	15,000	50,000	26,000	27,000	12,000
Hyderabad	3,653,000	400,000	2,888,000	300,000	3,234,000	300,000
Central India	1,426,000	273,000	1,314,000	206,000	1,400,000	228,000
Baroda	749,000	175,000	762,000	196,000	665,000	96,000
Rajputana ..	‡470,000	‡132,000	393,000	125,000	263,000	73,000
Mysore	93,000	16,000	154,000	19,000	101,000	17,000
Total ..	24,595,000	5,201,000	22,028,000	4,610,000	21,615,000	3,288,000

N.B.—A bale contains 400lbs. of cleaned cotton.

*Including Native States within provincial boundaries.

†Excluding Native States for which the yield is roughly estimated at 1,000 bales.

‡For the Mewar and the Alwar States figures reported in the December forecast have been taken to make up the total, as final reports from those States have not been received.

This year's crop is estimated by the commercial houses in India as being 6,000,000 bales.

Ginners' Returns.

The estimates of the growing cotton crop even in America are unreliable. With regard to the probable size of the crop, the ginners' returns have to be taken as the guide. It was for this reason that the International Federation suggested to the Indian Government four years ago that fortnightly ginners' reports, similar to those issued by the United States, should be issued. Hand ginning has practically died out, and by taking a census of the number of bales pressed by the 1,200 pressing factories in India, it would be an easy matter to obtain, fortnightly, the figures of the quantity of cotton pressed. The chief difficulty so far has arisen from the fact that the Native States, as a rule, are reluctant to give statistical information to Government officials. This difficulty has been overcome, however, by the Bombay Millowners' Association undertaking to collect the figures from the Native States. The various Provincial Governments of British India have recognised the value of the proposed system, and in the Central Provinces returns on this basis have been obtained for the last two years from the pressing factories. The owners of all the pressing factories in British India have declared their willingness to supply the figures to the Commercial Intelligence Department, and it is anticipated that with the beginning of the next cotton season we shall obtain more reliable data. This will enable us not only to gauge the extent of the growing crop (by comparison with previous years), but to arrive also at a definite figure for the total crop. It is intended at present that the figures supplied by each Province shall be published separately as soon as they are completed; but I would suggest, in order to reduce speculation, that the figures from all the Provinces and the Native States should be added together at one central office and be published in *one* table, stating separately the amount of cotton handled in each Province. Owing to the difference in time in the various cotton dealing centres of the world, due consideration should be paid to the hour when the publication is made, in order that neither India nor any other country should have an undue advantage. Perhaps the best plan to adopt would be to issue the fortnightly reports on the evening of every second Saturday, so that newspapers in all parts of the world could publish the figures on Monday.

It will, of course, be many years before the Indian returns of cotton pressed can be absolutely complete.

The possibility of checking the production by statistics of consumption is somewhat limited, owing to the fact that in addition to the Indian mill consumption and exports, there is a very large domestic consumption. This consumption was estimated at 750,000 bales, but latterly this figure has been reduced to 450,000 bales.

The following official table compares the estimates of outturn for the last three years with the sum of net exports and home consumption, this latter being computed on the basis arrived at in agreement with the Bombay Cotton Trade Association, Limited :—

000 omitted.

	Year ending Sept. 30th.		
	1913	1912	1911
Net exports	Bales. 2,307	Bales 1,773	Bales. 2,302
Mill consumption	1,806	1,731	1,551
Consumption outside mills (conjectural)	450	450	450
Total	4,563	4,004	4,303
Estimated yield	4,610	3,288	3,853
Excess (+) or Deficit (-)	+47	-716	-450

When the domestic consumption was taken as 750,000 bales, the difference between the estimate and actual crop was as follows:—

Year.	Bales of 400lbs.
1901	1,310,000
1902	1,173,000
1903	1,108,000
1904	663,000
1905	1,270,000
1906	428,000
1907	1,169,000
1908	1,133,000
1909	512,000
1910	247,000
1911	1,012,000

As cotton is largely used in India for padding jackets, quilts, &c., the domestic “outside mills” use is certainly considerable.

Reference to page 81 and to the Appendix, pages 236 to 240, is invited with regard to other statistical matter concerning the Indian cotton crop.

DAMPING OF GINNED COTTON ("RUI").

The following resolutions were unanimously adopted at various meetings of the International Federation :—

Salzburg, May 13-14, 1912.

"This committee invites the attention of the Secretary of State and of the Government of India to the practice adopted in some parts of India, by cotton-pressing companies, of artificially damping cotton, and solicits the introduction of legislative measures which will prevent the systematic watering of cottons in cotton ginneries or pressing factories, or in any place set apart for the artificial damping of cotton."

Scheveningen, June 9th, 10th, 11th, 1913.

"This Congress observes that the Government of India admits that the practice of damping cotton prevails in certain provinces of India, but that most of the Local Governments consider the remedy for its extermination lies in the hands of the trade.

"The International Federation of Master Cotton Spinners' and Manufacturers' Associations respectfully submits that the fact, that the practice is spreading in India and has not been checked, is proof that the trade is helpless, assuming that this term is meant to include cotton spinners.

"Between cotton traders on the one hand and cotton spinners on the other, the connecting links are numerous, and the two principal parties, viz., those who damp the cotton and those who use it, being separated by time and distance, do not come into direct contact, and such influence as the latter may have had has been lost and has not succeeded in causing any diminution in the practice.

"This Congress is therefore of opinion that fraudulent damping can only be stopped by legislation, and very respectfully trusts that the Government of India will, on further consideration, be able to introduce it."

The cotton export firms of the Karachi Chamber of Commerce, Messrs. Ralli Bros., Volkart Bros., Gaddum & Co., Ltd., sent a memorial to the Government of the Punjab inviting attention to the increase in the practice of watering and otherwise adulterating cotton in many markets of the Punjab, which had the effect of reducing the price obtainable for Punjab cotton, and of adversely affecting the remunerativeness of cotton cultivation.

The Bombay Millowners' Association and the Cawnpore Upper India Chamber of Commerce have passed similar resolutions to the first quoted.

A leaflet was issued by the Directors of Industries of the Punjab and the Central Provinces explaining the loss resulting from this fraudulent practice, but as no legislation is in existence little or no effect has been produced.

Lord Crewe, at the reception which he accorded to the International Cotton Federation on July 22nd, 1913, in referring to damping of cotton, and after speaking of the practice as "a fraud," said: "If

it be the case that the cotton trade considers itself helpless to prevent the fraud by trade regulations, I would certainly once more impress on the Government of India the possibility of undertaking some form of penal legislation, which at any rate might have the effect of intimidating some of those who would otherwise engage in it."

After this I was somewhat astonished that at an interview I had with the Hon. R. E. Enthoven, C.I.E., I.C.S., Secretary of Commerce and Industry to the Indian Government, he should maintain a decidedly negative attitude, although he recognised that the spinners had a great deal to contend with owing to this practice. I made it quite clear to him that the spinners did not look for the introduction of a second Bombay Cotton Frauds Act, that there was no need to employ a single additional official for the purpose of bringing offenders to book under the proposed Act, and that the spinners desire only that watering of ginned cotton—"rui"—should be made a penal offence. The spinners maintain that it is easy to ascertain which cotton ginners and pressers are practising the watering of cotton, as their number is small, and in the process of watering a number of operators are employed. I explained to the officials in India that the watering of cotton rots the fibre, and that the lint loses its colour. I explained further that the European spinner is not able on the arrival of the bales to detect that the cotton has been watered; it is only when the bales have been opened that he finds the damaged cotton, and as cotton is bought and sold in the open market he cannot trace the offender. The purchaser in India is in a different position.

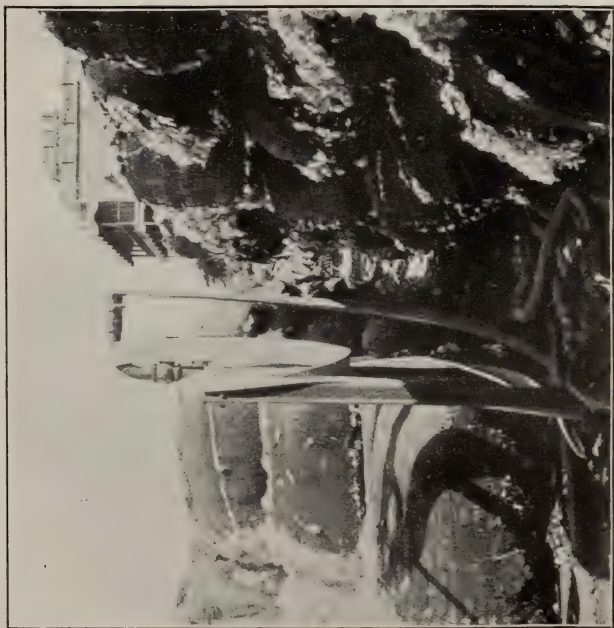
The character of the Indian is decidedly peculiar. Although he may have been found out in some underhand dealing nine times, he still speculates, trusting that the tenth time his fraud will not be detected. Even Indian gentlemen with whom I discussed this matter agree that the gambling instinct in the Indian has no parallel, and that it is difficult to persuade him to "go straight."

In the course of conversation with the Secretary of Commerce and Industry I discovered that the refusal of the Government to introduce legislation was due to the statements of certain officials who were quite mistaken as to the suggestions made by the International Federation. They had come to the erroneous conclusion that we desired to establish a maximum standard percentage of moisture, with a scientific examination of each lot of cotton exported.

I made it my business to discuss the question of damping ginned cotton with a Commissioner of Berar, Mr. F. G. Sly, C.S.I., I.C.S., and also with Mr. C. E. Low, C.I.E., I.C.S., Director of Agriculture of the Central Provinces, in whose districts this practice is largely carried on; in fact, outside these districts the only other places where the practice is in vogue are Kathiawar, in the south of Bombay Presidency, and to some slight extent in the Punjab. These officials did not see any objection to such legislation as the spinners desire.

The accompanying photographs will illustrate the watering of cotton as I have seen it done in Akola and at Amraoti. The excuse is frequently made that the watering is necessary for the purpose of pressing the bales to the required density, but the fact is that every press working at present in the Central Provinces, no matter how old it is,

WATERING OF COTTON AT AKOLA.



The hydrant at rest.



The hydrant at work.

is able to produce a bale of the requisite density whether the cotton is dry or damp. The whole of the cotton bought by the Japanese firms there is pressed in a dry state by Indian firms that also water cotton if specially asked for. It is true it might take an antiquated press longer to press a bale of dry cotton than to press a bale of wet cotton, but this is no justification for adding water.

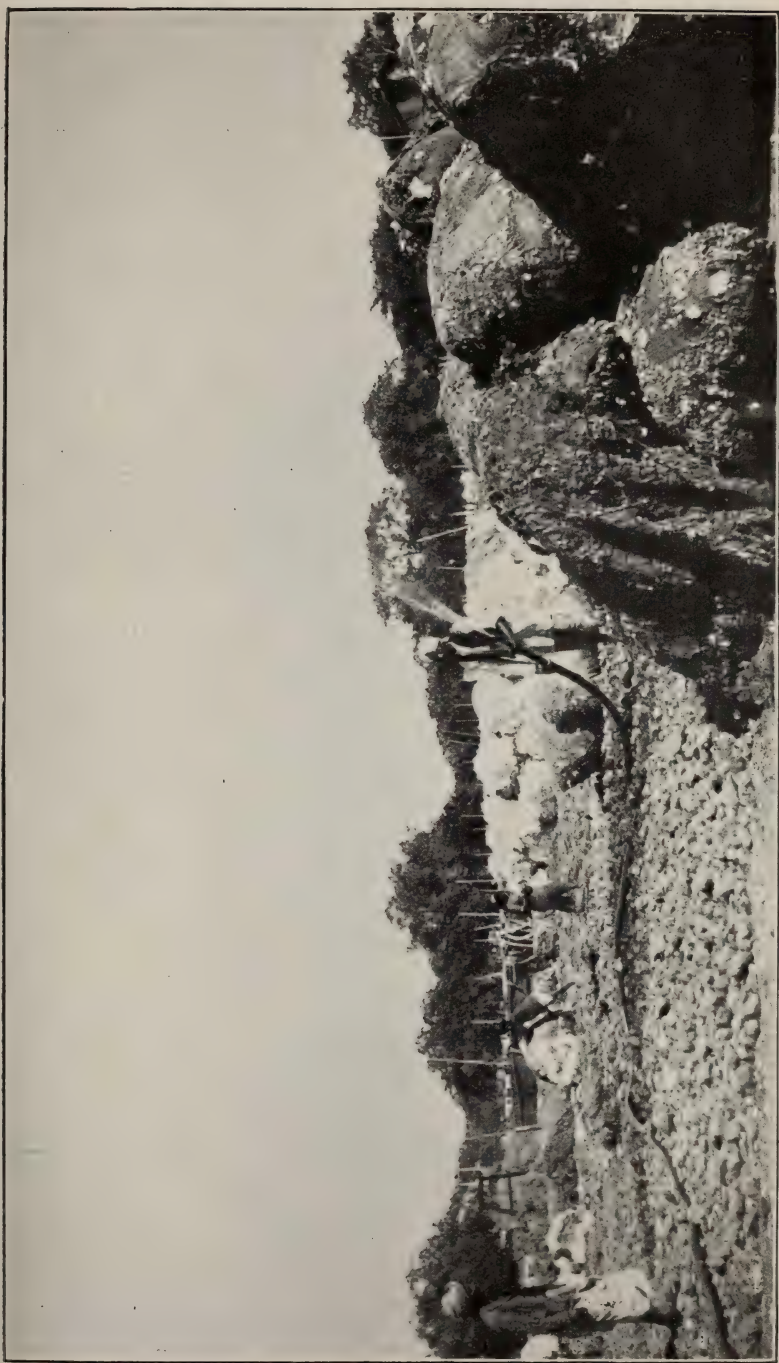
There is no doubt that the practice is extending, and naturally so, as the owners of presses look upon the passive attitude of the Government as sanctioning the malpractice. I have even seen the process of watering cotton at the press where bales are prepared for export direct to Europe. The following description explains the accompanying photograph :—

Extract from diary, December 23rd, 1913.

“In the company of Mr. J. R. Blackwood, I.C.S., Director of Agriculture for Bengal, I visited the ginning factory of ————. Immediately on our entrance to the yard, prior to the arrival of the manager, we noticed very wet cotton in loose bales, and saw that from the moist appearance of the ground it must have been recently very wet. The last rains had fallen on December 5th. At first the manager said the damp cotton was due to the rains which had come suddenly about 14 days ago, and that it had rained so fast that the men could not cover the cotton. After having been shown that the ground was wet, and after having had his attention called to the fact that the last rains had fallen three weeks before, the manager, a Parsee, confessed to damping by means of hosepipes. He said he never damped the cotton itself, but placed old gunny bags over it, and then watered the bags. He added that the pressing is facilitated, as on a dry day he would get only 380lbs. of cotton in a bale, while after he had damped the gunny bags over the cotton he would get 390lbs. in the same sized bales. On further cross-examination he said he only watered cotton that is to be pressed on behalf of Indian clients, and then only by their special request. His firm had given instructions not to water any cotton that belongs to them. He told me that in years of drought, in the district of Amraoti, a lot of loose bales of 140lbs. each would be watered with hosepipes for half an hour only, but when the quantity of available water was normal, as in the preceding year, then the hosepipes would play for a full hour on the bales.”

The watering of cotton is carried on largely at night, and I was told by another press manager that when there was a normal water supply fountains rose everywhere at Amraoti after sunset. I took the photographs during the day-time, and the managers of the presses were kind enough to show me how the watering process is carried on.

I lodged serious complaints at the head offices of the firm that is part owner of the press at Amraoti, and I have received the assurance that the practice will be discontinued. One European exporter told me that instant dismissal is the punishment for those who damp or water cotton in their presses, and I am convinced that the European exporters do not water cotton in their presses, as they recognise that they themselves would suffer. I saw at the press in Akola how portions of one wet bale were put into the centre of a dry bale while it was in



WATERING OF COTTON AT AMRAOTI (Central Provinces).

the process of being packed. This is the "false packing" also so much complained of by spinners. The exporting houses in Bombay maintain that a careful examination of a large percentage of all the bales that are sold by them is undertaken, and that it is they who suffer most from the fraud; they admit, however, that in some rare cases they might not be able to detect false packing.

I explained to meetings of the Cawnpore Millowners and of Bombay Millowners what I had seen at Amraoti and at Akola, and the following resolution was forwarded by the Upper India Chamber of Commerce to the Government :—

"This meeting desires again to draw the attention of the Government of India to the grave need for suppressing the practice of damping cotton which prevails in many of the cotton-growing tracts of India and which is known to be spreading."

The existence of a law making watering of ginned cotton a penal offence would undoubtedly act as a deterrent.

In face of the evidence I have been able to collect, I cannot imagine on what grounds the Government can continue its present attitude towards this question of damping cotton.

Messrs. Ralli Bros., in a discussion which I had with them, suggested that, with the object of putting a stop to the practice of damping cotton in the Berar, it should be made compulsory for all press and gin factory owners to secure licences to work their presses and gins, such licences to stipulate that damping of cotton at ginning factories at any time, or the pressing of artificially damped cotton would render the owners liable to a fine and suspension or forfeiture of their licences.

WATERING OF UNGINNED COTTON ("KAPAS").

The watering of kapas (unginned cotton) is more extensively carried on than the watering of ginned cotton. The evil of this is not so much that the buyer is cheated, but that the cotton loses its whiteness, becomes stained, and the seed loses its power of germination. The reputation of the cotton in a district where this watering is carried on thus suffers materially, and the seed which is used for planting purposes is very inferior. Both these disadvantages finally tell against the cultivator. It is quite the general thing in the North-Western Frontier Province for "kapas" to be watered. The accompanying illustration shows how cotton is transported in the North-Western Province, and some ten miles outside Peshawur I examined about 50



Method of conveying seed cotton from field to ginning factory in the
North-Western Frontier Province.

different loads, and not a single lot was in a dry state. The fact that the cultivators are in the habit of packing unginned cotton in a kind of string bag, which is carried on the back of a buffalo, seems to be in the main responsible for the watering, for when cotton is damp more can be pressed into the bags. In Burmah the practice is also in vogue. I have examined at various ginning factories the cotton as it arrived in farmers' carts, and the presence of moisture could at once be detected from the fusty smell that permeated the atmosphere. It must be said, however, that in Burma the principal buyers, who are ginner, have combined and resolutely refuse to take in any cotton that has been watered.

Seed cotton in a damp state does not pass satisfactorily through the gin; indeed, I think one can say that wet cotton cannot be ginned, therefore the spinner is safeguarded, and it is the ginner who suffers through this malpractice. The spinner's loss is in that he receives stained cotton.

I cannot conceive any measures beyond concerted action by the ginners of a district that would put a stop to the practice. Legislation seems impossible, as the culprits are too numerous. I was told in the North-western Frontier that frequently the cultivators, when bringing their seed cotton to the market, roll these string bags through a stream on their way to the factory. Where this is detected legislation might step in, just as a cultivator can be prosecuted for having secreted stones, or other foreign matter, in his cotton.

It is most essential that Government officials should treat separately the two methods of watering, viz., that of watering the seed cotton, and that of watering the ginned cotton.

HANDLING AND MARKETING OF INDIAN COTTON.

By far the largest proportion of the Indian cotton crop finds its way to Bombay, which is the largest cotton port of the whole of the East. Most of the cotton arrives in neatly packed bales and is stored in the open air on the "cotton green" at Colaba on **Cotton Green**, the south side of the island city. The accompanying photograph gives little idea of the magnitude of this enormous storage place. Thoroughfares cut through this cotton green, and no wonder that we frequently hear of fires, as people pass through these huge piles of cotton smoking cigarettes, cheroots, and



A small portion of the Cotton Green at Bombay.

pipes. Some of the recent fires have been attributed to spontaneous combustion consequent upon the exposure of artificially watered cotton to the severe heat.

This "firing" of the cotton seems possible, if a certain quantity of oil is present in the cotton. A great many seeds are often found in the bales and the oil from only a few of the seeds would suffice to set the fire going. Undoubtedly in the process of pressing the bales, some seeds, if they are close to each other and thus form a resistance, will break, and the oil will adhere to the adjoining fibres.

Very little cotton is sent to the "godowns," as stores are usually called in India. On the cotton green all banks and export houses dealing in cotton have certain squares, called "Jaithas," marked off for them, where they store their cotton. More than 50 per cent. of the total cotton crop is sent to this cotton green, and it is from here that the Bombay mills draw their chief supply. Only small quantities of cotton are sent in loose bales from the ginning factories to the Bombay mills; on the other hand, the Cawnpore, Ahmedabad, and Madras spinning mills, as well as the

few mills situated in close proximity to the cotton fields, receive most of their cotton loosely packed. The principal railways which carry the cotton crop to Bombay are the Bombay, Baroda, and Central India Railway serving the north, the Great Indian Peninsular Railway serving the east, and the Southern Mahratta Railway dealing with the South of Poona. Karachi is the collecting harbour for cotton from Sind, the Punjab, and the North-west Frontier Province. From here, cotton is generally carried in steamships to Bombay; sometimes sailing vessels are used, but the insurance premium for these native craft varies considerably according to the season, as very severe weather is at times experienced in the Indian Ocean. The insurance companies insure such shipments against total loss only. From June to October no insurance is accepted on these sailing craft. Freight is usually paid per Bengal maund or per 40 cubic feet to the ton; four bales occupy one ton measurement.

The cotton green at Colaba is situated in the opposite direction to the mill quarter, and although the railway has direct connection with this storage place, yet it is necessary to transport the bales in 2-wheeled bullock carts to the mills and harbour for shipment. Considering that only four bales can be placed on a cart, it will be readily understood what loss of time ensues. During the height of the season these bullock carts laden with cotton form a continuous string through the principal streets of Bombay. A scheme to enclose an area on the north-east side of the island of Bombay and fill it with mud from the sea is at present being carried out. This will be the new cotton storage place, on which it is intended to erect huge modern warehouses, and alongside which lighters can moor. This new cotton green is situated close to the spinning mill quarter of Bombay.

**Through
Bills-of-
Lading
wanted.**

It is strange that one cannot obtain through bills-of-lading from places in the interior to Europe and Japan. A Japanese cotton firm complained to me about the loss of time and money entailed in sending the bales, say from Akola, for shipment to Osaka, as the cotton has first to be sent to the cotton green at Colaba and then by bullock cart through the city to the harbour. It would be quite feasible to send the bales by rail from the interior direct to the harbour, and if this were done there should be no difficulty in obtaining through bills-of-lading from the principal cotton centres, as is done in the United States of America.

**Cotton
Exchanges.**

There are two cotton exchanges on the cotton green at Colaba, viz., The Bombay Cotton Trade Association, Ltd., which is entirely under European management, and the Bombay Cotton Exchange, Ltd., which is an institution of a local nature and is managed entirely by Indians.

About 30 cotton firms are shareholders in and members of the Bombay Cotton Trade Association. Some 100 firms, many of whom are Indian, are admitted as "associate members," but the management of the Exchange and the regulations and the alterations of statutes are entirely in the hands of the shareholders, amongst whom the European

element is in the majority. The term "room" is applied to both exchanges, and all cotton contracts are subject to the conditions of one or the other "room."

The cotton trade in Bombay is, however, not limited to the two exchanges; it is also carried on from office to office. There are further cotton bazaars in the native quarter of Bombay, and in every Indian town in the cotton-producing provinces business is transacted without the assistance of a cotton exchange; the Central Provinces and a few isolated places in the south of Bombay have municipal cotton markets. The large export firms have their own houses, frequently their own ginning factories, in the important places of the interior, and their agents buy the cotton that has been ordered from Europe or Japan, and thus it is that quite a large quantity of cotton, that has already been sold for abroad, passes through Bombay. The disadvantage under which these agents in up-country cotton centres are placed is that they are tied down by their principal house at Bombay, Karachi, or Madras to certain standards and certain prices, with the result that in cases where a comparatively small quantity of cotton superior to their standards is offered, the agents must send samples to the head offices and await instructions. In a country like India the facilities for forwarding samples, large enough to be useful, are much behind those in Europe, and 14 days are likely to elapse before an answer is received (see p. 96). Meanwhile, the dealer or ryot may be in want of money. If these agents had greater discretionary powers, it would help those ryots who have undertaken an experiment with new seed, and would cause the removal of one of the difficulties that the Department of Agriculture has when introducing a new variety of cotton. Business on the Bombay Exchanges is transacted through brokers, who act as agents for the presses and for the dealers in the interior, and attend to the requirements of the firms in Bombay; at times they buy and sell for their own account. There is no cotton "pit" on the Bombay Exchange, such as we find in Europe and America, and consequently no calling aloud of the prices. The Indians have a peculiar system of communicating the prices secretly to each other: they shake hands under a shawl, and by the pressure of the thumb on the knuckles they indicate the prices. It is said that in this manner a large business was done up to recently, and that, comparatively speaking, few cases arose where a buyer or seller repudiated the price indicated in this manner. This system is, I am told, dying out. The brokers receive $\frac{1}{2}$ per cent. commission from the seller on the selling price.

All contracts on "*Colaba terms*" are subject to $5\frac{1}{2}$ per cent. discount; of these there are three distinct subdivisions:—

Colaba Terms.

(1) *Railway Delivery Terms*.—The seller endorses the railway receipt to the buyer against receipt of an advance of 90 per cent. of the value. The $5\frac{1}{2}$ per cent. discount is taken off and the balance is paid on inspection of the cotton. The buyer has no commission to pay.

(2) *Office Terms*.—Delivery under these conditions takes place at the "godown" of the seller or his agent. One-half per cent. commission is payable by the buyer to the seller or his broker.

(3) *Mill Terms*.—Delivery takes place at the godown of the seller, but besides the above-mentioned $\frac{1}{2}$ per cent. commission, 8 annas have to be paid per bale to the storekeeper of the buyer.

In contracts with European sellers “terms as usual” are mostly written in the contract form and it is understood that “office terms” are meant. In transactions on office or mill terms the quality is ascertained on the basis of samples and the buyer has the right to take samples from 5 per cent. of the bales of the entire lot. These samples are sealed, and in case the delivery turns out inferior to the sample according to which the sale has been made, the contract is cancelled.

In the case of export contracts a clause is added according to which the seller agrees to a measurement of 100 bales per 26 tons.

A difference is also made between “ready contracts” and “forward contracts.”

Ready Contracts. “Ready contracts,” *i.e.*, for spot cotton, do not offer any peculiarities. The broker draws up the contract according to the wishes of the buyer and the seller signs it, but the buyer does not furnish the seller with any written documents. The cotton which is lying in Bombay is inspected by the buyer, and after payment of the value is taken over. At times it is stipulated in these contracts that arbitration in Europe shall be binding, so that the seller in India may have to refund to the exporter an allowance that may be fixed in Europe. This is known as a “home guarantee.”

Forward Contracts. As regards “forward contracts,” the broker must make out for each transaction a contract form in duplicate, of which one form has to be signed by the seller and to be handed to the buyer, and the other form must be signed by the buyer and handed to the seller. The broker has to counter-sign both forms. Every contract form must contain the number of the contract, the name of the broker and the names of both parties, also the number of bales bought, the origin and definition of quality, the price agreed upon, and the measurement per 100 bales and the delivery time and place. It is customary for transactions to be for quantities of 100 bales or more.

The standard weight of cotton in Bombay is a candy of 784lbs., and two bales weigh this standard; prices are made per candy, less $5\frac{1}{2}$ per cent. discount.

Origin. As regards the definition of origin, the Exchange has clearly defined the places from which the cotton must come in order to be classified as Bengal, Sind, Punjab, Rajputana, Oomrah, &c. Only such cotton as has been grown in the places named in the official list is allowed to be tendered. The bales must bear the name of the place and the railway station. No such definition is laid down for Broach and Dholera, owing to the vastness of the territory in which these cottons are grown. Unless it is stated definitely that the cotton must be hand-ginned, the cotton may be ginned by hand or power machine, but the whole lot must have been ginned by the same method.

Class. As regards classes a number of differences are made ; good, fully good, fine, and superfine, are the better ones ; the lower grades are termed : good, fair, and fully good fair.

Bale Regulations. The bales have to be fully pressed, that is to say, 100 bales must not occupy more than 30 tons of 40 cubic feet measurement ; in other words the bale must not measure more than 12 cubic feet ; if the bales measure more, they are refused by the buyer as not being " full pressed," but generally the bales are much smaller in volume ; as a rule 100 bales occupy only 26 tons measurement. Sea freight is calculated per ton of 40 cubic feet measurement, and it is therefore in the interests of the exporter to see that his bales are well pressed.

Delivery. As regards delivery time, a certain amount of latitude is given ; the 25th of each month is the settlement day and up to the 25th of each month the seller has time to send the buyer his delivery order, *i.e.*, instructions to his store-keeper to hand over a certain number of bales. The buyer may endorse this delivery order to his neighbour, to whom he may have sold the same quantity of cotton, and so on, until the order is received by that firm which takes delivery. This buyer has to pay to the first seller the amount stated in the delivery order, whilst he must settle the difference between the original price and the purchase price with the last intervening seller ; if he has bought at a higher price, then he must pay, but if his purchase price is lower, then he receives the difference. The intervening buyers and sellers settle in the same way their price differences. If the seller does not deliver, the buyer has the right either to cancel, or to buy for account of the seller in the open market, or to claim the difference between the purchase price and the market price officially fixed on the day of delivery. The seller has also the right, if the buyer does not accept delivery, to sell the cotton for account of the buyer or to demand the difference between the selling price and the market price. It is quite a frequent occurrence that " forward contracts " are regulated in this manner through the payment of differences instead of actual delivery. The Indians are extremely fond of speculating in cotton in this manner.

Sampling. If the contracted cotton is delivered, the buyer sees whether it corresponds to the sample or class. He is allowed to open for this purpose 5 bales per 100 and to withdraw samples in the presence of the seller or his agent. If he demands an allowance for difference in class or quality, he resorts to arbitration, when a friendly settlement cannot be arrived at. Arbitrations are almost the rule in Bombay,

Arbitration. as the cotton is in most cases below the particulars stated in the contract. The court of arbitration is held according to the rules of the two " rooms." If the decision is an allowance of more than R. 5 per candy of 2 bales, or if the cotton falls short a full grade or half a class (if this difference is more than R. 5), of the class contracted for, the buyer has the right, instead of agreeing to the allowance, to refuse acceptance of the cotton. In this case he

will buy the cotton for account of the seller, or he will sell back to the original seller the cotton at the price ruling on the day on which the arbitration was held, *i.e.*, he demands the difference between the price ruling on the day of the arbitration and the contract price.

During the cotton season the members of the "rate committee" of the Bombay Cotton Trade Association publish daily the market price of each class and grade, with the exception of the 25th of each month, which is settlement day. On this day the Directors fix the prices. These prices form the basis for the settlement of all claims arising out of arbitration. If the cotton delivered is better than contracted for, the seller receives no allowance. For this reason he is more likely to deliver cotton that is inferior in class to that contracted for. In case one of the parties is not satisfied with the arbitration, he has the right to appeal. The court of appeal examines the same bales from which the original arbitration samples were drawn.

As soon as the arbitration is completed the cotton is weighed by the buyer, and after ascertaining the weight, payment is made. Eight pounds per bale are usually deducted for tare. It is generally assumed that the bale of Indian cotton weighs 392lbs. nett and 400lbs. gross.

Cotton Export Firms.	There are about 30 firms in Bombay which devote themselves exclusively to the exportation of cotton to Europe. Mitsui Bussan Kaisha and the Japan Cotton Trading Company undertake the export of cotton to Japan.
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A few Indian firms have from time to time tried to sell cotton to Europe, but the houses in Europe to whom the cotton was shipped have in almost every case had to give up such connections. The cotton business consists, more than any other commercial undertaking, of transactions in which the one party must be able to rely absolutely upon the integrity and fairness of the other.

The cotton exports for 1912 were handled by the following firms:—

Shipments from		Bales.
Bombay :	Ralli Brothers	106,714
	Volkart Brothers	61,148
	Gaddum & Co.	59,464
	W. Wolf & Sons	35,850
	E. Spinner & Co.	25,155
	Bombay Company, Ltd.	20,645
	A. Blascheck & Co.	20,389
	Various other firms	101,450
		<hr/> 430,815 <hr/>
Karachi :	Ralli Brothers	105,022
	Volkart Brothers	58,969
	Bombay Company, Ltd.	16,511
	Various	15,938
		<hr/> 196,440 <hr/>

Madras :	Volkart Brothers	35,204
	Ralli Brothers	21,234
	Dymes & Co.	8,330
	Various	5,918
		<hr/>
		70,686
		<hr/>
Cocanada :	Ralli Brothers	20,791
	Volkart Brothers	19,494
	Dymes & Co.	2,500
	Various	1,620
		<hr/>
		44,405
		<hr/>
Calcutta :	Ralli Brothers	16,095
	Ernsthausen & Co., Ltd.	11,946
	Various	7,218
		<hr/>
		35,259
		<hr/>
Tuticorin :	Ralli Brothers	17,743
	Gaddum & Co.	5,080
	Volkart Brothers	2,925
	Dymes & Co.	2,850
		<hr/>
		28,598
		<hr/>

The shipments to Japan were :—

Bombay	899,779
Calcutta	23,632
Karachi	35,844
Tuticorin	69,150
Cocanada	9,275
Madras	14,909

1,052,589

All the European exporters of Bombay have their own houses in Europe, or, at all events, agents duly qualified to adjust any claims or differences arising out of shipments. Arbitration on Indian cotton is undertaken on the Liverpool and Bremen Exchanges, but cotton shipped to Japan is arbitrated upon in Bombay, not in Japan.

A Futures Market for Indian cotton does not exist on the European Cotton Exchanges.

The exporter draws for the value of the cotton shipped on his own house, his representative, or a bank in Europe that has been mutually agreed upon between the spinner and exporter. The draft, together with the bills-of-lading, is handed to a bank in Bombay for encashment, and this bank credits the exporter at once with the full amount of the draft, subject to its being properly met. The banks also make advances to exporters on the cotton lying on the cotton green.

During the last few years, Messrs. Weld & Co., of Bombay, have made some shipments of Indian cotton to New York.

In 1911-12 the exports of Indian cotton to Europe were very small. The extraordinarily high prices that ruled during that season for Indian cotton were responsible for the decline, as American cottons were cheaper, when due allowance was made for the greater waste in the spinning of Indian cotton. In that year the Indian millowners imported, for the same reason, from the United States, about 100,000 bales of American cotton.

Consumption. The *world's consumption* of Indian cotton, calculated on the basis of the International Cotton Federation's statistics, was during the last five years as follows:—

APPROXIMATE NUMBER OF BALES ACTUALLY CONSUMED
BY THE SPINNING MILLS OF THE WORLD.

Country.	1909.	1910.	1911.	1912.	1913.
Great Britain ..	63,000	90,000	105,000	43,000	50,000
Germany	345,000	380,000	378,000	226,000	230,000
Russia	25,000	28,000	32,000	20,000	18,000
France	116,000	123,000	132,000	83,000	94,000
Austria	210,000	236,000	233,000	162,373	154,138
Italy	280,000	280,000	300,000	200,000	220,000
Spain	35,000	62,000	70,000	15,000	33,000
Switzerland	4,300	4,500	4,300	3,000	3,400
Belgium	80,978	88,907	97,021	60,998	82,409
Sweden	9,000	18,000	20,000	6,000	4,000
Portugal	820	600	1,200	1,200	800
Holland	17,864	18,219	16,634	8,822	10,927
Denmark	2,538	2,242	1,451	331	63
Norway	903	1,306	1,859	894	1,491
India	1,600,000	1,500,000	1,551,000	1,781,000	1,806,000
Japan	680,000	916,000	820,000	812,000	990,000
	3,470,403	3,748,774	3,763,465	3,423,618	3,698,228

APPROXIMATE NUMBER OF BALES IN STOCK AT THE
COTTON SPINNING MILLS.

Country.	1909	1910	1911	1912	1913
Great Britain	11,250	21,200	17,100	11,300	15,100
Germany	108,200	128,900	92,700	60,000	68,000
Russia	6,000	11,000	8,000	5,000	9,000
France	53,327	52,992	43,544	36,534	45,906
Austria	71,619	76,004	66,625	59,359	66,944
Italy	40,000	60,000	60,000	35,000	36,000
Spain	8,500	9,000	7,000	5,000	6,000
Switzerland	1,700	1,500	900	1,000	1,550
Belgium	28,012	25,974	29,207	28,513	24,042
Sweden	4,000	9,000	7,000	800	1,400
Portugal	300	100	260	390	260
Holland	3,723	3,842	3,119	2,178	3,004
Denmark	122	327	561	—	55
Norway	378	679	609	593	487
India	695,000	492,000	537,000	680,000	632,000
Japan	233,546	243,600	237,520	386,264	453,582
	1,265,677	1,136,118	1,111,145	1,311,931	1,363,330

The Statistics of Mill Stocks on 1st March, 1914, as per compilation of the International Federation were very heavy—in some countries twice as big as usual—which leads to the conclusion, that during 1913-14 the consumption of Indian cotton has been a record one. It is certainly more than ever recognised that some Indian cottons are well suited for improving the colour of American cotton. Indian cottons are excellent for hosiery yarns.

The above figures are probably the surest guide to the size of the actual crops in each year, as the figures for these have been supplied by the individual mills. On reference to the Government figures of yield, published in the Appendix, enormous differences become apparent.

Table showing the Commercial Classification of the Principal Indian Cottons.

General name of the Growth.	Subdivisions of the Growth according to		Remarks.
	Province or District.	Towns.	
Broach or Surtee-Broach.	{ Broach Surat	Gujurat. Surat, Nausári, and others.	{ Very white, good staple and silky, $\frac{7}{8}$ " to 1" staple (26-30 m/m).
Kumpta	South Bombay {	Dhárwár. Gadag. Hubli.	
Saw-ginned Dhárwár	Do. {	Gadag. Hubli.	{ $\frac{5}{8}$ " to $\frac{7}{8}$ " staple (19-22 m/m), dull, yellowish, silky.
Westerns.....	North Bombay ..	Annigeri, Bágalkot, Sholápur, Belgaum, Bijápur, Miraj, and about 30 others.	
	Nizam's Dominion	Raichore and 5 others.	{ White, sometimes yellowish, dull, silky, mixed (20-24 m/m).
	Madras	Bellary and 12 others.	
Dhollera	Cutch	About 10 towns.	{ White, silky.
	Northern Gujarát	About 20 towns.	
	Káthiáwár	Wadhwan, Bhavnagar, Junágad, Dhollera, and about 40 others.	{ From many of these places a variety known as "Mathia" is also obtained which is distinguished thus: "Bhavnagar (Mathia)."

Table Showing the Commercial Classification of Indian Cottons (continued).

General name of the Growth.	Subdivisions of the Growth according to		Remarks.	
	Province or District.	Towns.		
Oomras(or Oomrawatti).	Beláti	Berar	Amráoti and 10 others.	10-25 m/m.
		Central Provinces.	Nágpur, Pulgaon, and 10 others.	
		Khándesh ..	Jalgaon, Dhulia, and about 20 others.	
	Khándesh	Central India	Indore and about 6 others.	10-16 m/m.
		Central Provinces.	Burhánpur. Harda. Khandwa.	
		Berar	Akola and 20 others	This is Oomras proper and fairly long in staple.
		Hinganghát	Hinganghát and about 2 others.	Long staple, 1" to 1½".
		Bársi	Bársi and 10 others	
		Nagar	Ahmednagar and 10 others.	
		Rájputána	Kekvi and 20 others.	
	Bengals	Central India....	—	White, with yellow stains.
Assam		Comilla.		
United Provinces		Cawnpore and about 20 others.		
Sind, Punjab....	Sind and Punjab	Over 30 stations in Sind and Punjab.	Short staple, ¾" to 1".	
Cocanada	Madras	Cocanada and Gantur.	Pure white, at places dull white and at others silky	
Tinnevelly	Do.	Coimbatore and about 12 others.	White, at times khaki, silky and strong.	
Tinnevelly American, or Cambodia.	Do.	South of Madras and Bombay Presidency.	Very white, at times cream.	
Northerns	Do.	North of Presidency.	1" and more, long staple, heavy yielder; second "flush" inferior quality.	
Burma.....	Burma.....	Upper Burma.	Fast improving, strong, white.	
Lyallpur American.	Punjab	Lyallpur.	¾", white, often mixed with khaki.	
			¾" to 1½", very white.	

PART III.

The Punjab—Proposed Model Plantation.

The North-West Frontier Province.

The United Provinces of Agra and Oudh.

The Central Provinces and Berar.

The Madras Presidency.

The Bombay Presidency.

The Native States.

Assam.

Burma.

Part III.

THE PUNJAB.

The word PUNJAB means the land of five rivers. These rivers are the Jhelum, Chenab, Ravi, Beas, and Sutlej. The Punjab forms, together with Cashmir and the North-western Frontier Province, the north of the Indian Empire. The area of the province is almost 100,000 square miles, and the population numbers roughly 20,000,000, with an average density of 200 per square mile, the Mohammedan population being in the majority.

The Punjab supplies 6·9 per cent. of the total cotton crop of India; 1,809,000 acres are reported to be under cotton, which is an increase of almost 25 per cent. upon last year. I have every confidence that this province will continue to extend its cultivation of cotton, and that it will become a much more important factor in the supply of cotton than it has been in the past.

For geographical purposes, five natural divisions are made:—

- (1) The Himalayan tract in the north-east.
- (2) The north-western part, separated by the Salt Range.

These two are quite distinct from the remainder of the country, which is almost a plain. The Himalayan tract is uninhabited. The Salt Range tract has a population of about 145 to the square mile.

(3) Along the base of the hills is a narrow tract, comprising a very fertile, and consequently densely populated, part of the province, there being over 400 to the square mile.

(4) and (5) The plain regions are divided into two very dissimilar tracts; the country east of Lahore receives a sufficient rainfall to enable cultivation to be carried on, but the country west of Lahore has only a slight rainfall, owing to the fact that the two Indian monsoons become exhausted by the time they pass over it. Cultivation would be impossible were it not for irrigation. Between the river valleys are extensive plains of an arid character, which only require a regular supply of water to turn them into fertile and flourishing regions.

Irrigation. The irrigation works undertaken in the Punjab are probably the most important that have ever been constructed in any part of the world, and, what is more, they have proved to be very remunerative to the Government and a great boon to the population.

The area irrigated by the productive works has increased between 1901 and 1911 by 2,700,000 acres, and the percentage of net revenue on the capital outlay has shown a steady increase during the last 10 years, as will be seen in the following table:—

1911 1912
IRRIGATION DEPARTMENT, PUNJAB.
GENERAL MAP.

SCALE—IN MILES 1 INCH
0 10 20 30 40 50 60 70 80 90 100

REFERENCES	
Canals navigable	—
not navigable	- - -
under construction	—
projected	- - -
Railways and Stations	—
under construction or surveyed	- - -
Principal Towns	•
River Gauges	•
Irrigation Headworks	•
British Boundary	- - -
Pahals	—
Nakhs	—
Kells	—
Jind	—
Faridkot	—
Katwa	—

W. T. BENNETT, C.E., C.S.I.
Chief Engineer, Irrigation W. & A.



	Per cent.		Per cent.
1900-01	11.20	1906-07	13.68
1901-02	11.52	1907-08	11.64
1902-03	11.39	1908-09	12.26
1903-04	12.02	1909-10	12.78
1904-05	12.29	1910-11	13.66
1905-06	10.66	1911-12	16.13

The total capital outlay up to 1911-12 on the Punjab Canal Productive Works was over £12,000,000 sterling.

The following table shows the areas irrigated by the Punjab Canals in 1911-12 :—

MAJOR IRRIGATION WORKS.

	Acres.
Western Jumna Canal—	
Imperial	703,348
Patiala State	72,102
Sirhind Canal—	
Imperial	1,052,582
Patiala, Nabha, and Jind States.....	556,876
Upper Bari Doab Canal	1,156,808
Lower Chenab Canal	2,334,090
Lower Jhelum Canal	799,649
Upper Sutlej Canals	266,013
Sidhnai Canal	249,570
Indus Canals	278,607
Total Major Irrigation Works—	
Imperial	6,840,667
Native States	628,978

MINOR IRRIGATION WORKS.

Shahpur Inundation Canals—	
Imperial	22,860
Provincial	20,686
Ghaggar Inundation Canals—	
Imperial	6,593
Bikaner State	—
Lower Sutlej Inundation Canals (including Hajiwah Canal)	242,877
Chenab Inundation Canals	182,571
Muzaffargarh Inundation Canals	377,362
Ravi Inundation Canals (Provincial)	9,241
Rangoi Canal (Imperial)	57
Total Minor Irrigation Works—	
Imperial	832,326
Provincial	29,921
Native States	—
Total Major and Minor Irrigation Works—	
Imperial	7,672,993
Provincial	29,921
Native States	628,978

Grand Total 8,331,892

The most important work of irrigation undertaken is undoubtedly the Triple Canal Project. It includes the Upper Jhelum and Upper Chenab and the Lower Bari Doab Canals. The Upper Jhelum Canal starts from the left bank of the Jhelum River in Cashmir and carries the surplus waters of the Jhelum, after the needs of the existing Lower Jhelum Canal have been supplied, down to the Chenab River, above the head works of the existing Lower Chenab Canal, for the purpose of replenishing the supply available in the Chenab River and of making a like quantity available for the Upper Chenab Canal, which is higher up the river. A branch of the Upper Jhelum Canal will at the same time irrigate 350,000 acres in the Gujrat district. The Upper Chenab Canal, which is the middle link of the Triple Canal Project, will irrigate annually 648,368 acres, half in "kharif," half in "rabi" crops.

The Upper Jhelum Canal is the uppermost of the three canals of the Triple Canal Project. It will irrigate, annually, 172,480 acres in "kharif," 152,400 acres in "rabi," and allow about 20,000 acres in the "rabi" crop, first and last waterings only. The Lower Bari Doab Canal is the third of the Triple Canal Project and is a direct continuation of the Upper Chenab Canal. It has been designed to irrigate 877,908 acres annually out of a total irrigable area of 1,637,000 acres. Most of this land is at present waste, growing nothing but desert plants.

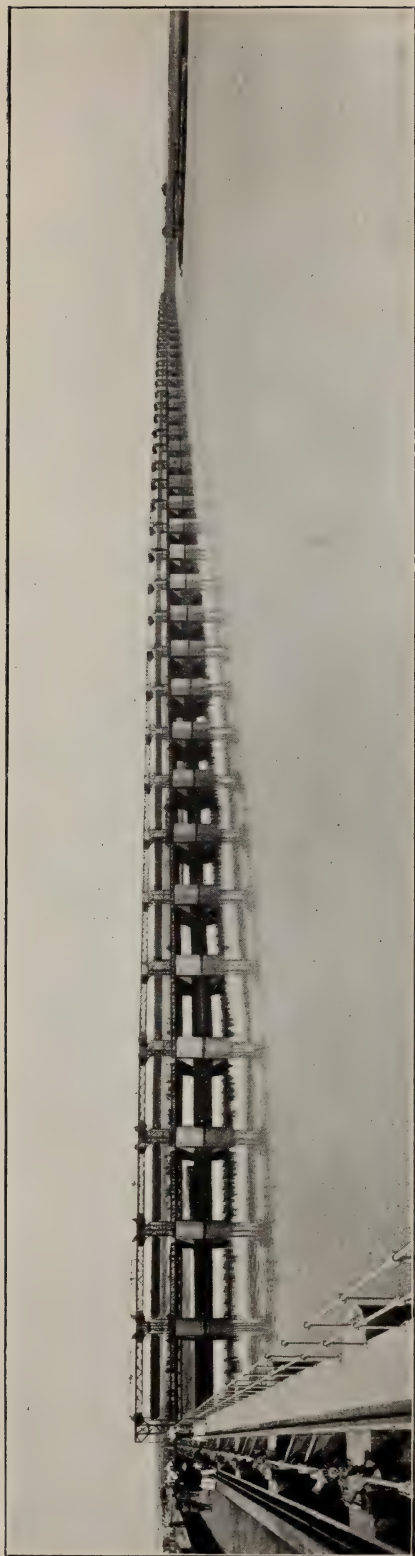
The headworks are situated on the river Ravi near Balloki village in the Lahore district; and as the cold weather supply of that river has already been utilised for the Upper Bari Doab Canal, they have been designed to hold up and pass on from the Upper Chenab to the Lower Bari Doab Canal the supply required for irrigation. The usual type of headworks has accordingly been modified and a barrage (or level crossing) of 35 spans, each 40 feet in width, has been designed, with gates $12\frac{1}{2}$ feet high. When there is no appreciable supply in the river Ravi this barrage has to prevent any portion of the valuable supply received from the Upper Chenab Canal from being lost by leakage, and during the monsoon it has to pass river floods estimated at 200,000 cusecs as a maximum.

The accompanying illustration shows the enormous work carried out by the Public Works Department.

The whole of the Balloki Weir was constructed by the Public Works Department of India. The brick foundations took two years to build, whilst the iron and steel work was erected in 11 months. The weir cost approximately £200,000. A weir must not be confounded with a dam. A weir merely acts as a stop to water in the river and directs the necessary quantity through a regulator into a canal; a dam serves to pen the water up in a reservoir and to dole it out according to requirements.

There is another weir of peculiar construction in this canal scheme. On a crescent wall across the river iron doors are placed, and these hold the water up to the extent of 5 feet 8 inches. When the flood comes, the first of the doors is knocked down and automatically one door after another falls and permits a free flow of the water.

The total cost of the Triple Project is estimated at about £6,900,000. Work was started on the Upper Jhelum and Upper Chenab Canals in



[Photo by Brenner & Co., Lahore.]

THE WEIR AT BALLOKI.

This forms the headwork to the Lower Bari Doab Canal in the Punjab. The bridge on the right-hand side shows the inlet from the Upper Chenab Canal. On the extreme left is the Regulator, taking the water into the Lower Bari Doab Canal. Doab means a stretch of country between two rivers. Bari is a composite word made up from the names of the two rivers, Beas and Rabi.

1905, and on the Lower Bari Doab in 1907. The expenditure up to the end of 1911-12 was: Upper Jhelum £1,712,000, Upper Chenab £1,814,000, Lower Bari Doab £809,000. The Upper Chenab Canal, though not fully completed, was opened in April, 1912. The scheme constitutes a very material advance towards converting the Punjab, from the Indus on the west to the Jumna on the east, into a vast irrigated tract permanently insured against famine, and an important granary both for



Marala Shutters at the head of the Upper Chenab Canal.

Indian requirements and for export; it is calculated to turn the waters of the Punjab rivers to the greatest advantage, without in any way interfering with the possibility of further schemes for utilising the Beas for the Sutlej valley, and the Indus for the Sind-Sagar-Thal.

The *Sutlej Valley Project*, now under consideration, aims at utilising the surplus supply of the *Sutlej and Beas rivers*, and would, besides improving the water supply of the several inundation canals now dependent on the Sutlej, extend the benefits of irrigation into the great desert south of the river. The cost is estimated at £6,000,000 and the irrigable area at 3,000,000 acres.

Practically 80 per cent. of all Punjab cotton is grown on irrigated land: the remaining 20 per cent. is raised under rain cultivation, called "barani." The rain crops are mostly near the base of the hills. Twenty-five per cent. of the area irrigated is the outside limit which can be put under cultivation during the hot weather (kharif), and cotton is one of these kharif crops; thus 75 per cent. of the irrigated area lies fallow during the hot weather.

**Land
Tenure.**

All land in the canal colonies is divided into plots of about 25 acres. These plots are termed squares; five to ten of such squares may be considered an average holding. Land in the colonies was given to men who had rendered some service to the Government, but these landlords do not in every case cultivate the land themselves; they often reside in the neighbouring cities and let the land to yearly tenants on the half-share system, caring little whether the tenant is a careful cultivator or not; the tenancy being only a yearly one there is of course a tendency to take as much out of the soil as possible. A tenant generally looks after $12\frac{1}{2}$ acres = $\frac{1}{2}$ square.

The kharif irrigated area, *i.e.*, 25 per cent., which is only of interest as far as cotton is concerned, is generally divided up as follows: 1 acre maize, 1 acre sugar, 1 to $1\frac{1}{2}$ acres fodder (all three crops for the cultivator and his cattle), 4 to 5 acres cotton (for sale). Owing to the high price of cotton, there has latterly been a tendency to use more land for cotton.

Whilst in Sind the word "zemindar" means a large landowner who sublets his land, in the Punjab the word denotes any tiller of the soil.

**Water-
logging.**

In some of the irrigated districts of the Punjab waterlogging has taken place, and after the experiences which Egypt has had owing to inadequate drainage one cannot but be astounded at seeing that in many parts of the irrigated tracts of the Punjab there is a complete absence of drains. I was told that in some districts the subsoil water is rising several feet every year in consequence of the large quantity of irrigation water that has of late years been brought on to the land. The seepage from the canals is also important and in some places the experiment is being made of lining the canals with cement in order to prevent it. The dangers of bringing up salt, &c., are anticipated by some authorities, although in many parts the subsoil water is said to be very deep. At Lyallpur, for instance, experiments are being carried out by the Principal of the Agricultural College, and it has been found that the subsoil water is rising $1\frac{1}{2}$ feet every year.

**Ashford's
Tube-Well.**

In consequence of the waterlogging in some districts the Public Works Department instructed the superintendent of the Amritsar workshop, Mr. John Ashford, to investigate the question of pumping up the subsoil water with a view to directing it to a canal or river. Various tube-well pumps were tried, but it was found that none worked satisfactorily, as the fine sand particles would in the course of weeks or months impede the output and finally make pumping impossible. Ultimately, Mr. Ashford constructed a frame tube upon which square copper wire is wound so as to form a sieve, or better a screen, fine enough to exclude even the finest sand. Choking of the tube is said to be impossible. This pump serves the two purposes of removing the subsoil water and irrigating the land.

I heard a sanitary inspector of a neighbouring town say that Ashford's pump had been constructed at the same time as another Indian tube-well pump; both pumps were working close together

under identical conditions, but while Ashford's pump had maintained its output the other tube pump was fast becoming choked.

The first of Ashford's tube-wells was constructed two and a half years ago and has been in use in the compound of the Public Works Department for 12 hours every day. The special strainer tube is 30 feet long and 5 inches in diameter; attached to the upper end is an ordinary suction pipe to which is coupled a centrifugal pump, driven by a 3 h.p. electric motor. The capacity of the pump is 148 gallons per minute, *i.e.*, sufficient to irrigate 4 acres per day of 12 hours. The cost per day is 3s., taking the price of the unit at 1d. A small oil engine would consume about 3 pints of oil per hour. The cost of the installation is about £100. These tubes and pumps are manufactured by the Public Works Department.



Ashford's Tube-Well.

The above illustration shows a larger pump. It has a 10-inch tube with a special strainer tube 100 feet long, to which is coupled an ordinary suction pipe 34 feet in length. On this is fitted Ashford's patent tube-well pump, for which a "sump," *i.e.*, a pumping pit, is not required. The total cost of the installation was £500. The power required is 16 h.p., and the quantity of water delivered is 700 gallons per minute, or sufficient to irrigate one acre per hour, approximately. By way of comparison it may be stated that the ordinary Persian wheel, used in Northern India, irrigates one acre per 24 hours, working constantly. For this purpose three pairs of bullocks and three men are required. In other words one 10-inch tube-well is equal in efficiency to 20 to 24 Persian wheels. The ordinary brick or stone well with Persian wheel costs from Rs. 1,000 to 1,600, according to varying conditions. The bullocks cost Rs. 70 to 120 each, and their average life is 10 years. They cannot work longer than eight hours per day. Wages for the men in attendance range from 6 to 12 annas.

The special tube-well is the result of experiments carried out by the Irrigation Department for the purpose of pumping such volumes

of water from sandy water-bearing soils as would justify the employment of engine power. The most economical method of installing these pumps in a district with suitable subsoil would be to divide the area into plots of 500 acres, each to be served by a 10-inch tube-well, the whole arranged round a central generating station where the electric current would be produced at high tension for distribution to substations, and thence to a group of pumps. Such an area might extend to 25 square miles for one generating station. A special feature of this tube-well pump is that it can be started from a distance. It is not necessary for an attendant to be at the pump for starting purposes. In many other pumps it is necessary for an engineer to start the suction. There are many districts where the soil-surface is not commanded by irrigation canals, and for such the pump is designed. The electric power will in many cases be obtainable from the artificial falls, frequently constructed on irrigation canals for the purpose of reducing the level. The Punjab Government has at present such a scheme under consideration.

General Crops.	The land in the Punjab may be classed as growing :—
	50 per cent. wheat.
	25 per cent. toria (a rape seed, <i>brassica campestris</i>).
	16 per cent. cotton.

9 per cent. fodder (jowar, millet, &c.).

Sengi-Mellilotus, is a customary nitrogenous crop round Amritsar, but it is not a general crop round Lyallpur, as it requires water at the time when the growing wheat most needs the water. It is sown between the cotton rows prior to the last picking. Sengi gives a much heavier crop than berseem, but a smaller percentage of nitrogen.

Kinds of Cotton.	The cotton crop is well liked by the cultivators of the Punjab, because the principal work connected with it falls at a time when no other pressing agricultural work requires their attention. Next to the cotton crop the wheat crop is the most important. Wheat is rotated with cotton.
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Indigenous Cotton.	The Punjab produces two fairly good indigenous cottons, called Hansi and Multan. They are $\frac{5}{8}$ inch in staple, and yield 7 to 8 maunds of seed cotton per acre. The average ginning out-turn is 33 per cent., but some of the cottons around Multan have given as high a ginning out-turn as 40 per cent. There are a few indigenous kinds of cotton with a longer staple, say $\frac{7}{8}$ inch. Punjab cotton is often sold in Europe as "Surtee Broach."
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The local (Deshi) cotton comprises a mixture of four different varieties, viz., G. Indicum, G. Neglectum, G. Sanguinum (red), G. Hirsutum (American). I noticed the four varieties growing in one field within an area of 2 square yards. The Department has improved the Sanguinum kind, and has supplied a fair amount of seed to cultivators.

The local cotton suffers from root rot, probably caused by a kind of ear cockle worm, but at present it is of no great importance. One notices occasionally a round empty spot of about 15 inches in diameter

from which the plants have entirely disappeared. The botanist is at present investigating this root-rot pest.

American Cotton. Dharwar American cotton has been grown along the Chenab Canal for the last nine years, and since 1908 its cultivation has been on an extensive scale. This cotton was originally introduced into Dharwar, South of Bombay Presidency, some 50 years ago, but it seems to flourish better in the Punjab than in Dharwar. In 1911-12 some 600 bales of the crop were sold to a large Admedabad spinning mill at the price of "fully good fair American." The Department of Agriculture did not push the general introduction of this cotton, as it was found that year by year the quality improved, and it was desirable to accumulate a sufficient supply of seed before recommending it as a substitute for the local variety. The officials of the Department are inclined to think that the farmer does not obtain a sufficiently high price for this American type of cotton, which is certainly worth much more than the indigenous kind. A premium of Rs. 2 per 80lbs. is now paid by the local buyers. It must be taken into account, however, in judging this cotton, that it is badly picked, being often full of leaves and sticks. These impurities get into the cotton during the picking, because the plants, especially after a frost, become very dry and brittle. There is also a certain unevenness of staple. The improvement in quality has certainly continued and the length of the staple is becoming more uniform. I noticed a great difference since my last visit, and I was confirmed in this opinion by the cotton buyers of two large European export houses. In a great number of fields the length of staple measured fully 1 inch, and the fibre was very strong, certainly stronger than the American cotton grown in Sind.

The Department had obtained two special kinds of American cotton through plant selection, one of which, known as 3F, a smooth-leaved variety, is early maturing. Seed for 400 acres was distributed during last season, but, unfortunately, in many places 3F was attacked by an insect, "Jassides," or "Tela" in Punjabi. This insect is a kind of greyish fly, which attacks the bottom part of the leaves and causes a shrivelling up of the plants. The pest has never before been noticed in the Punjab, and it is possible that it will only occur on rare occasions; nevertheless the Department has decided to give up 3F, although it is early maturing and has a fine fibre, measuring 1 inch in length. Undoubtedly the confidence which the Department of Agriculture enjoys amongst the cultivators has been somewhat shaken by this unforeseen occurrence, but if compensation is given to those who were supplied with seed, it will soon be restored.

The local cotton suffers severely at times from bollworm, but neither the bollworm nor the root rot has, so far, affected American cotton in the Punjab. Experience has shown that when there is a strong wind during the period of irrigation many bollworms drop off and perish in the water.

The Jassides insect has not attacked the rough-haired leaf variety of American cotton, and, fortunately, the Department of Agriculture has three such varieties, viz., 4F, 280F, and 161F. 4F and 280F are excellent, with a good ginning out-turn and strong fibre,

measuring 1 inch in length. 280F has a lustrous appearance. The drawback, in comparison with 3F, which was attacked during last season, is that these varieties are 10 to 15 days later in maturing. In appearance of fibre there is hardly any difference between 3F and 4F. Although the latter has been grown side by side with 3F it was not attacked by the pest. So far 80 acres of 4F have been grown by farmers around Lyallpur. This crop will give sufficient seed to plant 1,600 acres in the next sowing season. The yield of 4F was 8 maunds of 80lbs seed cotton, with a ginning out-turn of 32 per cent. The cultivation was undertaken under the supervision of the Department.

The average yields of local and American cotton throughout the whole district may be estimated at 5 maunds per acre, although under European supervision a much higher yield is obtainable. In exceptional cases the officials obtained as much as 18 maunds to the acre of 4F. The only disadvantage in planting 4F is that the picking extends from November to December, whilst all local cotton is picked by December 15th. Frost comes early in December. In the Punjab nine pickings are generally made.

I was informed by the owner of a ginning factory at Lyallpur that last season the 440 gins of the town ginned 16,000 maunds of 80lbs. of American Punjab cotton, that this year he expected 30,000 to 35,000 maunds of indigenous cotton, and at least 25,000 maunds of American. There is no doubt that American cotton has grown rapidly in favour with the Punjabi.

If the large export firms, which in other provinces possess their own ginneries, were to establish ginneries in the Punjab, or would hire some for their exclusive use, the spinners would receive a large quantity of *pure* American Punjab cotton.

Lyallpur Agricultural Station supplies selected seeds of
Seed "Hansi" and "Multan" cotton and of Dharwar-
Distribution. American in very small quantities. There is also a
 seed farm at *Sargodha* which supplies selected seed to
 the Jhelum Colony. The amount of selected seed supplied in this
 way is comparatively small.

In the Punjab, the necessity for the almost exclusive supply of seed by the Government is patent, as no means can be found of compelling the ginners to keep the various kinds of cotton apart. In a former report I suggested that the Government should insist upon the colonies, along the new canals, growing American cotton with seed supplied from the Department, but I understand the recommendation has not been adopted owing to the insufficient quantity of seed at the disposal of the Department. Evidently the fact that the local seed and the American seed are so easily distinguishable has not been taken into consideration, as the Department could easily purchase ample quantities of seed at the ginneries, and sell it to the cultivators after sorting. In Egypt the Department of Agriculture buys seed from the ginning factories, has it sorted and then distributed. Children could perform the work in the Punjab, as the difference between the two kinds of seed is so marked. It is evident, also, that the growing

of seed by the Department is not yet on a sufficiently large scale, and it is to be hoped that the Department will set aside, in the new Lower Bari Doab Colony, an extensive area for the purpose of producing its selected seed and distributing it *on credit* to the cultivators.

In this connection I may mention that Mr. T. H. Conville, who has, for many years, been manager of the firm of Volkart Brothers, Lyallpur, has received a free grant of 3,000 acres in the Montgomery district, for the main purpose of establishing a cotton seed farm on the lines of the Akola nucleus seed farm of the Central Provinces. In his application for the grant, Mr. Conville called attention to the resolutions adopted at various times by the International Federation with regard to the necessity for seed distribution by Government on a large scale. This undertaking will, of course, be of a private character.

Closer Connection Between Government Officials and Mercantile Community Wanted. In practically all the Provinces I noticed an absence of concerted action between the export houses and the Government officials; and I would strongly recommend that the Director of Agriculture and the Deputy-Directors should become affiliated members of the various Chambers of Commerce. The knowledge they possess of the cultivation of cotton and of all the other crops would make them invaluable members. In the United Provinces this plan has been followed, and in Madras the suggestion was immediately adopted.

The Punjabi a Good Cultivator. Generally speaking, the Punjabi is a very hard-working man, willing to follow the advice given by the agricultural experts of the Department. The Indian of this district is eager to make money, and his character is undoubtedly above that of the average Indian. As long as the Punjabi can see some financial gain at the end of his labour he will work hard, and try new methods. This quality is absent both in the African native, and in the negro of the United States. To its existence must be attributed some of the extension which has taken place, during the last few years, in cotton-growing in the Punjab. The Punjabi is undoubtedly an excellent farmer, probably less conservative in his methods than his European confrère; he has, for instance, taken more quickly to the reaper than was the case in Europe; and his use of the steel plough is increasing year by year.

Ginning Factories. The ginner fix the price of indigenous cotton regardless of the length of staple. Their only gauge is ginning out-turn. The cotton is bought outright by the ginner, but only in rare cases does he buy direct from the farmer. The latter sells his crop to the "Bania," or dealer, who advances him money on the crop before it is picked. The bania collects the various lots and sells them to the ginner, hence some of the mixing. Ginning on commission is not undertaken in Lyallpur. After the cotton has been ginned it is put up in temporary bales called "boras," and it is afterwards pressed again for transport. Everywhere in the handling of cotton at the factories there is an enormous waste of labour, and if one considers that, owing to the lack of labour in the season,

the wages of an ordinary labourer reach 12 annas, one would think that the installation of suction pipes, cranes, and light railways in the ginning factories would be of economic advantage.

Mixing of Cotton. The great mischief, which practically nullifies the work of the Department of Agriculture, is done in the ginning factories, whose owners act as buyers. A large exporter of cotton assured me that out of 40,000 bales he sent from Lyallpur last year, not more than 40 bales were pure American. I was repeatedly assured by Indian brokers that only a few lots showed as little admixture as 50 per cent., and that the majority of the lots bought from the ginners showed 90 per cent. of local cotton and 10 per cent. of American. In the fields of the farmers I saw American cotton growing almost pure, and I could only explain the fact of there being so few bales of pure American by the ginners mixing the two kinds.

The remedy is the issuing of "ginning licenses," as is done in the Anglo-Egyptian Sudan. The licenses should stipulate that mixing or watering the cotton will be regarded as an offence that would cause the withdrawal of the license. Messrs. Ralli Brothers have suggested this measure to the Government of India.

Mixing Reason for Unsatisfactory Price. The mixing is the real reason why the large cotton brokers cannot pay any high premium for cotton that is offered as American. In view of this custom of mixing the cotton by the owners of the ginning factories, I visited several of these factories, and I am convinced that the mixing is quite general. It is easy to notice how much local cotton is added to the American cotton by watching the seed kernels falling from the gin. The local cotton seed is greyish and comparatively smooth, whilst the American, grown in the Punjab, is greenish and fluffy. The consequences of such mixture in the gin are far-reaching indeed. The fact that the buyer and spinner are perhaps cheated is one of the lesser consequences, because they will sooner or later find out where the fraud is perpetrated. The worst consequence arises when the seed is sown in the following year. The variety must deteriorate, and the reputation of the Punjab cotton, which the Department of Agriculture is anxious to build up, is bound to suffer. I have watched the farmers' carts coming into the ginneries, and have found that practically all contained pure deliveries of American cotton. I have explained to the ginners and farmers that the shortest fibre in any one lot of cotton, whether only 10 or 20 per cent. is present dictates the price; but some of the ginners replied that this was not their experience. Only in two ginning factories at Lyallpur did I see special stores for American cotton. In the others the indigenous and American kinds were promiscuously mixed. The Punjab American cotton is quite as good as American cotton grown in Sind, where the difference between the American and local cotton at the time of my visit was Rs. 5 to 6 per 80lbs., due probably to the existence of a Buying Agency of the Bombay Cotton Syndicate. As mentioned above, in Lyallpur only Rs. 2 per 80lbs. seed cotton are paid as premium.

I certainly think that the export firms in India are working their businesses on too machine-like a basis. If cotton of a grade and quality, different from the ordinary standards, is offered to any of the branch houses, these must send samples to the head office and await instructions, which often take 14 days to arrive.

Agricultural Associations. The Agricultural Associations of the Punjab are now progressing. They carry out demonstrations in about 40 places, on behalf of the Department of Agriculture. The Department of Agriculture is about to start a demonstration farm in Hissar in the Western Punjab.

Damping Seed Cotton. As regards the damping of seed cotton in the Punjab, I was told by several export houses that, at Hansi, Sagoda, and other places, the walls of the cotton warehouses are regularly damped. The Director issued, last season, a circular to the owners of ginning factories drawing attention to the fraud; but of course he was not able to state that punishment would follow, as the law does not forbid the damping.

Rotations. The principal crop rotations are
 1st year, wheat.
 2nd year, wheat.
 3rd year, toria (oil seeds).
 4th year, cotton,
 but gram, millet, and sugar cane are also employed.

Government Farm. The Lyallpur Government farm consists of 500 acres, of which
 85 acres are devoted to the botanical section,
 135 acres are devoted to the experimental section,
 200 acres are let out to tenants, and
 40 acres are worked by the college students.

The whole farm is self-supporting. The tenants work on the half-share system, and carry out field experiments under the supervision of the staff of the Department.

New Agricultural Farming Experts Wanted. In view of the extension of the cultivable area through irrigation, an increase in the staff of the Department of Agriculture has become imperative. Some of the teaching staff of the Agricultural College at Lyallpur will, it is hoped, be able to devote more attention to field work, as the College is not at present fulfilling the purpose for which it was intended.

Manure. Land near the villages is manured with cow dung and village refuse to some slight extent. It is unfortunately the custom in the Punjab to use cow dung as fuel. It is said that the heating power of these cakes is equal to the same weight of the best coal, and that they burn very slowly.

When cotton follows sugar-cane there is no need to manure the fields but as a result of my enquiries I found that very little manure is ever given to the land in the Punjab on which cotton is to be raised.

PROJECTED MODEL COTTON PLANTATION IN THE LOWER BARI DOAB CANAL COLONY.

The extension of cotton-growing in the Punjab will be considerable in the near future, as by the end of this year, or the beginning of next, vast stretches of land will receive water from the newly constructed canals. I was specially interested in the quality of the soil, and the whole aspect of the land along the Lower Bari Doab Colony. I travelled the distance three times between Lahore and Khaneval, and can liken the physical conditions to those of the Gezira in the Anglo-Egyptian Sudan. The land is quite level, and little clearing requires to be done, only a few desert shrubs are growing here and there and desert grass sprouts up after a little rain. The soil is undoubtedly capable of producing cotton equal to that of the Lyallpur American type, and as the Government, at the time of my visit, was on the point of selling and leasing the land amongst cultivators who had rendered some special service to the Government, I discussed with the officials the possibility of spinners undertaking the establishment of a cotton plantation.

The following copies of letters exchanged with the Government of the Punjab explain the project for the establishment of a Model Plantation which I had in mind :—

Terms of	(Camp) Agricultural College,
Lease.	Coimbatore,
(Copy.)	12th December, 1913.

To the Director of Agriculture and Industries of the Punjab, (Camp),
Coimbatore.

Sir,

I have the honour to submit through your medium, for the consideration of the Government of the Punjab, a project for a cotton plantation, to be worked by the International cotton spinners, in conjunction with a ginning factory and a cotton-buying agency for American cotton, in the Lower Bari Doab Colony of the Punjab.

The principles of such undertaking are to be—

(1) Free 20 years' lease by Government of cotton land to be used as a model cotton plantation, with option of renewal after expiration of lease. The spinners to pay the annual charges, as water rates or other customary revenue taxes, on land actually under cultivation. In case of refusal on the part of the Government to renew the agreement, Government to purchase the buildings.

(2) The area to be sufficient to produce at least 1,000 bales of cotton annually.

(3) The spinners to undertake to cultivate as large a percentage of area with American cotton, as is commensurate with the supply of water, with proper rotations of crops and with the available supply of labour.

(4) The Department of Agriculture to have the right to purchase any surplus seed which the spinners do not require for the estate. Reasonable storage facilities for seed to be given by the spinners.

(5) Establishment by the spinners of an up-to-date ginning factory.

(6) Establishment by the spinners of a cotton-buying agency, *i.e.*, the spinners would buy certain quantities of standard types of cotton on the basis of a price to be made known prior to the planting season. For further explanation I may state that the standard samples could be valued by different experts and the average difference between the price of middling American in Liverpool and the value of the standard samples would be taken as the basis, in other words the spinners would be able to issue a notice that they would be prepared to buy at so many points below or above the market rates ruling in Liverpool at the time of purchase of the cotton.

(7) Limit of net profit to the spinners to be fixed at 10 per cent. per annum over any average period of five years, the surplus to be paid to the Department of Agriculture.

(8) The agricultural portion of the estate to be under the supervision of an experienced European Agricultural Expert.

(9) The land to be cultivated by the Indian natives on the usual Punjab half-share system, but under the supervision and management of the spinners.

(10) The tenants to be at liberty to sell their shares of produce to anybody, provided they are not in any way indebted to the company.

(11) As far as possible steam levellers, steam ploughs, and other modern agricultural implements would be introduced; the extent of such use will depend on the suitability of the soil and labour conditions.

(12) Nothing will be undertaken that might be justly interpreted as an unfair exploitation of the Indian.

The scheme suggested itself to me during my tour of inspection of the cotton districts of the Punjab, in view of the careless method of ginning (mixing of seed) and the lack of fair competition in the purchase of the raw material.

Although I have no authority to enter into any contract I feel sure that my Committee would entertain a proposition from the Government on these or similar lines. I therefore respectfully ask for an option for the land, stating the full conditions which the Government desire to make. I would incorporate this option in my report to my Committee on my tour through the cotton-growing districts of India and the scheme would then be discussed at a meeting of the International Cotton Federation in June or July, 1914, after which a special company would have to be formed under the auspices of the International Federation, as the latter is precluded by its statutes from embarking on any commercial transaction. The option would, therefore, have to extend to the end of September, 1914.

The proposed undertaking would, according to my opinion, be an excellent medium for teaching the cultivators of the district intensive farming, it would spread the cultivation of American cotton in consequence of the basis of price, fixed in advance, and, finally, the Government would have the absolute assurance that no exploitation is carried out, owing to the limitation of profit.

As the undertaking is to a large extent an agricultural educational movement with a comparatively small return on the capital invested, and as with the prosperity of the company the ryots gain financially,

I could not advise my Committee to expend any money in the purchase of the land ; indeed, the undertaking should be a valuable supplement to the work of the Agricultural Department.

As Indian millowners form part of the International Cotton Federation, they would have an opportunity of becoming partners or shareholders in the concern. I have so far mentioned the scheme to Mr. S. M. Johnson, of Cawnpore, and he quite endorses it.

My address during the next six weeks will be c/o. Thomas Cook and Son, Bombay ; I intend to return to Manchester towards the middle of February. I am, Sir,

Yours faithfully,

(Signed) ARNO SCHMIDT, Secretary.

(Copy.)

No. 1168.

From W. S. Hamilton, Esq., I.C.S., Director of Agriculture and Industries, Punjab.

To Arno Schmidt, Esq., Secretary, International Federation of Master Cotton Spinners' and Manufacturers' Associations, Manchester.

Dated Lahore, the 7th April, 1914.

Sir,

I am now authorised to offer your Federation a lease of an area not exceeding 10 square miles, or 7,500 acres at the most, on the Lower Bari Doab Canal for cotton growing on the conditions given in your letter of 12th December last.

(2) If your Committee accepts the offer will you please communicate the names of the individuals forming the company in whose name the land will be ?

(3) You should also take early steps to select a block of land in communication with the Colonisation Officer, Montgomery.

(4) You will hardly be able to obtain 1,000 bales of cotton—your stipulated minimum—from 7,500 acres (of which only 26 per cent. is promised irrigation in each kharif crop), but it will probably not be difficult to secure the growing of American cotton from your seed in the immediate neighbourhood of your land.

I have, &c.,

DIRECTOR OF AGRICULTURE AND INDUSTRIES,
Punjab (R.R.), J.P.

I was assured by several experts in the Punjab that the proposition to establish a model cotton farm would be an excellent thing for promoting the growing of cotton of a superior kind and for introducing a rational system of cultivation.

In the following pages I beg to submit my personal views regarding the formation of a limited company to **Financial side and method of working the Plantation.** take the scheme in hand, and I also give some particulars relating to the working of this estate, and to the financial side of the undertaking. I may mention that I have submitted these notes to an agricultural expert with an extensive knowledge of the conditions obtaining in the Punjab and his opinion is that the estimated profits are put, if anything, at too low a figure.

I would propose the formation, under the auspices of the International Federation of Master Cotton Spinners' and Manufacturers' Associations, of a Limited Liability Company, to be called "The International Cotton Spinners' Experimental Indian Plantation, Limited."

The capital to be £60,000 (frs. 1,500,000) in £20 shares (approximately frs. 500 or M. 400), which would be called up as follows:—

£2. 10s. on application,

£2. 10s. on allotment,

£2. 10s. not sooner than 12 months after allotment.

£2. 10s. not sooner than 18 months after allotment.

£2. 10s. not sooner than 2 years after allotment,

£2. 10s. not sooner than $2\frac{1}{2}$ years after allotment.

The uncalled portion, amounting to £15,000, would serve as a guarantee to the banks when cotton shipments are being handled.

The lease is for 20 years, free of any payments beyond the customary annual charges, such as water rates and land revenue; but these charges are payable only on the area actually cultivated. This means that only the land which brings revenue to the company is chargeable. In the adjoining Lyallpur Canal Colony it is customary for the tenants to pay the water rate.

The purpose of the company would be to establish a model cotton plantation, not on a commercial basis pure and simple, but rather as an object lesson for the benefit of India and of the cotton industry of the world as a whole.

A system of intensive cultivation would be introduced, and it is hoped that the example shown by the company would cause other landed proprietors in India to adopt similar methods, and so increase the yield per acre, and materially improve the quality of the cotton.

It is proposed to grow American cotton, which is produced with success in the neighbouring district of Lyallpur, which has similar, but not quite as favourable, conditions as the Lower Bari Doab Canal Colony.

The advantages which would result to the spinning industry are the improvement in, and extension of, cotton cultivation in India, by demonstrating what can be achieved by the adoption of better methods than those which have prevailed hitherto.

The model plantation would sell selected seed to the Department of Agriculture and to cultivators; and the Department of Agriculture has reserved to itself the right to purchase any surplus seed which the company may not require for its own purposes.

The company would be under obligation to return to the Government of the Punjab any profit in excess of 10 per cent. per annum over any quinquennial period. This limitation of profit has been introduced in order to guarantee to the Government that there will be no exploitation of the Indians. It is, however, thought that the return on the invested capital would be such as to ensure a fair interest.

All the nationalities affiliated to the International Federation of Master Cotton Spinners' and Manufacturers' Associations would have an opportunity of subscribing for shares. The allotment would be undertaken by a board of directors, and due consideration would be given to

the consumption of Indian cotton and the number of spindles in each country.

The company would erect a modern ginning factory on the estate, and it is proposed to purchase cotton of superior quality from the surrounding districts. In my opinion, all cotton grown or purchased by the company should be sold by auction, in the open market at Bombay, to the highest bidder.

The company would be obliged, by the terms of the lease, to engage an efficient European agricultural expert to supervise the agricultural work ; provisional arrangements with a capable gentleman have been entered into with reference to his taking charge of the agricultural side of the project.

The estate would be worked on the half-share system, which is customary in the Punjab, the tenant receiving half the produce for the work he undertakes, and the company the remaining half share in lieu of rent. The tenants would have to obey the directions of the agricultural superintendent of the company.

Charges for work carried out by the Company on behalf of the tenants, such as ploughing by steam tackle, cutting wheat, &c., would be paid by the tenants pro rata to the acreage occupied.

The tenants would be at liberty to sell their own share of their produce to any person, provided they are not in any way indebted to the company, which would have a lien on the crops of the tenants until their debts are discharged. It is desirable, however, that arrangements should be made with the tenants to sell their cotton crop, in any case, to the company, at market prices.

At present there is hardly any population in the district, but no difficulty whatever is anticipated in directing the flow of population from other parts of the province, which are at present overpopulated, to the plantation if good houses are provided and fair treatment is given. It is of course understood that nothing would be undertaken by the company which might in any sense be interpreted as being an exploitation of the Indian.

The company would have to erect ten villages. The cost of building a good house for a tenant and his family is estimated at £10. The number of villages may appear high, but it has to be considered that by spreading the population over a number of villages there will be less danger of the spread of contagious diseases.

The capital expenditure during the first year would be comparatively small ; it is anticipated that it will take five years to bring the whole area under cultivation, and it is not likely that a satisfactory financial return would be obtained during the first few years of the existence of the company.

The cost of administration has been estimated at £2,500 for the first year, this amount being made up of the salary of the agricultural expert (£1,000–£1,200 per annum), travelling expenses, wages of colonisation agents, directors' fees, and upkeep of offices in Europe and India.

The services of an experienced cotton expert, as buyer and commercial superintendent, will be required in the second year ; his salary would be about £600 to £800 per annum. I would suggest someone for this position who has had practical experience in cotton

spinning, and who thus possesses a general knowledge of machinery. This knowledge is indispensable on account of the large quantity of machinery which would be employed on the estate. This official would also have to undertake temporarily the work of the agricultural expert, during the absence of the latter.

Steam tackle (disc-harrows) costing about £3,500 for the first year, and an additional £3,500 in the third year, would have to be purchased. The cost of working the steam tackle, and depreciation, would be £1,000 per annum. Once the land is cleared, this charge would be debited to the tenants pro rata to their acreage.

The whole of the ten villages (each village consisting of 60 houses, costing £600 to erect), would only be required when the estate is fully developed. The building of the villages would be spread over three years.

Cattle and agricultural implements would have to be bought for the tenants, but the value would be recoverable from the crops. The company must be prepared to advance up to £2,000 for the purchase of the cattle and agricultural implements.

Construction of wells, and sundry expenses against capital expenditure, would be £1,000.

The cost of erecting the ginning factory would be £7,000; this includes an efficient press. This factory would gin the cotton bought from other growers as well as the cotton grown on the company's estate, and would also undertake ginning on commission. It is well known that ginning factories can easily be made remunerative. For this reason no figures of receipts and expenditure of the ginning factory are given in the statement below. Depreciation of ginning plant and houses, working expenses, administration of the factory, &c., would be covered by the charge for ginning.

Steam threshing implements would cost about £2,000, but the depreciation and working expenses would be covered by the charge made for threshing.

Two bungalows would have to be built for the European staff, one costing £1,000, and the other £800. The store-building and offices are also estimated to cost £1,000.

Depreciation on buildings and cattle should be taken as £1,000 per annum, when the estate is fully developed. Depreciation of machinery is provided for in the working expenses.

The following statements give the approximate receipts and expenditure of the estate when fully developed:—

RECEIPTS.	Rupees.
Cotton, 1,500 acres at 7 maunds of 82lbs. each seed cotton nett per acre. (1 maund paid for picking 7 maunds) at	
Rs. 8 per maund	84,000
Wheat, 3,000 acres at Rs. 40 nett per acre.....	120,000
Straw, yielding Rs. 10 per acre, but taken at half.....	15,000
Rape seed, 1,500 acres at Rs. 30 nett, threshing deducted..	45,000
Cotton seed	10,000
Balance, 1,500 acres fallow and catch crops.....	—

Rs. 274,000

= £18,266

Half share to company = £9,133

EXPENDITURE.

	£
Administration—salaries.....	3,500
Depreciation of buildings	1,000
5 per cent. interest on paid-up share capital of £45,000....	2,250
	<hr/>
	6,750
Balance available for contingencies	2,383
	<hr/>
	£9,133

Profits from ginning, which are estimated at 10 per cent. nett on the capital cost of the factory, would be placed to reserve fund.

Steam ploughs, threshing machinery: Depreciation, working expenses, and 10 per cent. profit would be provided for in the charge to tenants.

The following statement will show what amount of capital will be required in each of the first three years:—

£		
1,200	} £2,500 {	Salary of expert.
500		Travelling expenses.
300		Salary of colonisation agents.
500		Expenses of European office and directors' fees.
3,500		Cost of steam tackle (disc-harrow and ditcher and grubber).
1,000		Cost of expert's bungalow.
1,000		Cost of offices and store.
2,000		Cost of village buildings (one-third).
1,000		Cost of wells.
2,000		Advances to tenants for cattle and seed.
500		Cost of running and repairing first set steam tackle.
2,000		Cost of threshing machinery.
<hr/>		
15,500		

SECOND YEAR.

£	
1,200	Salary of expert.
800	Salary of commercial superintendent.
500	Travelling expenses.
800	Salary of colonisation agents, expenses of European office, and directors' fees.
800	Cost of second bungalow for European.
3,500	Cost of second set of steam tackle.
2,000	Cost of village buildings (second one-third).
7,000	Cost of ginning factory and press.
200	Cost of reapers.
500	Cost of running and repairing second set of steam tackle.
<hr/>	
17,300	
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After the first two years the cost of running and repairing the steam tackle and the sum required for depreciation thereof would be provided out of the charge made to the company's tenants for the hire of the tackle.

THIRD YEAR.

£	
2,000	Salary of expert and commercial superintendent.
500	Travelling expenses.
1,000	Salaries of colonisation agents, &c., expenses of European office, and directors' fees.
2,000	Cost of building the last third of villages.
800	Cost of additional reapers.
<hr/>	
6,300	
	DEDUCT
3,500	Amount of salaries, &c., which should be paid out of profits, say, £3,500, leaving only £2,800 for the third year's capital expenditure.
<hr/>	
2,800	
<hr/>	

			£
First year	..	..	15,500
Second year	..	..	17,300
Third year	..	..	2,800
			<hr/>
			35,600

The tenant's unit of holding is taken as $12\frac{1}{2}$ killas = $13\frac{1}{4}$ acres, which is the customary area worked by a tenant with a native plough. In the above calculation 600 tenants' houses have been provided for. but it would probably be found that, with steam tackle working, only 400 houses would be required, which would reduce the capital expenditure by £2,000. On the other hand, the larger population on the estate would be a great advantage during the cotton-picking season.

THE NORTH-WEST FRONTIER PROVINCE.

The North-west Frontier Province, constituted in 1901, lies to the north and west of the Punjab, the Indus forming the dividing line for the greater part of the distance. The province falls into three main geographical divisions—the Indus district of Hazara, a wedge extending into the outer Himalayas, with fertile plains at the base; the comparatively narrow strip of administered territory between the Indus and the hills, with varied characteristics; and the rugged mountainous regions between the administered districts and the borders of Afghanistan. The climatic conditions are extremely diversified. The province has two wet seasons, but the rainfall is precarious.

Irrigation. A large proportion of the canals in this province are privately owned. The principal Government canals are the Lower Swat River Canal, and the Kabul River Canal, these two canals irrigate the area north and south of the Kabul River. In 1905 two new projects were sanctioned, the Paharpur Canal, branching off from the Indus, north of Dera Ismail Khan, and the Upper Swat River Canal, branching off from the Swat River, near Chakdara. The former was completed in 1909, and in 1911-12 irrigated some 25,000 acres; the latter is a bold undertaking, involving the construction of a tunnel over two miles long under the Malakand Pass. It is almost completed. The cost is estimated to be over £1,200,000. The canal will serve the large irrigable area lying to the north of the Kabul River, and will supply water to about 381,000 acres annually. There is a possibility of extension of cotton in the tract that will be irrigated by the Upper Swat Canal at the end of this year. The area suitable for cotton here will be 50,000 to 70,000 acres.

In the North-western Province we must distinguish between (1) canal irrigated tracts, and (2) tracts which are watered by cutting an outlet in the banks of the hill streams.

Cotton Area. The total area available for cultivation is very limited, as the province is very mountainous. Cotton is only cultivated in the valleys and on the plateaus. The total area under cotton last season was 59,000 acres, representing an increase of 5 per cent. on the previous year. The estimated yield is 14,000 bales, representing about .3 per cent. of the whole of the Indian crop.

The area under cultivation depends largely on the presence of water in the hill streams in February, March, and April, which is the time for sowing cotton. Should the water fail at that period the cultivators are obliged to wait for the tilling of their soil until July, when the hill streams are invariably full. In this case, however, they can only sow maize, it being too late for cotton.

**Cotton
better in
flooded than
irrigated
Tracts.**

It is strange that in the tracts irrigated by canals cotton does not do as well as in the districts which are flooded. The staple in the former is considerably shorter, and the yields are also less. I am inclined to think that too ample use of water is the main reason for the defects in cotton raised on canal-irrigated tracts. A further reason is undoubtedly the presence of heavy dews in the canal-irrigated tracts in September, when the cotton is ripening. These prevent the bolls from opening properly, and shorten the growing season considerably. These dews also account to some extent for the dirty picking, as leaves and bits of sticks adhere to the moist fibre. In stream-irrigated tracts there is an absence of the dews, and the season is longer, as frost appears later. The difference in the quality of the cotton in these two tracts, within, say, 5 miles of each other, is astounding: in one tract the cotton is quite white, soft, strong, and the staple up to 1 inch in length; on the other it is yellowish, and the staple only about $\frac{5}{8}$ inch long. The yields also vary very much. Cotton in canal-irrigated tracts yields 6 to 7 maunds of 106lbs. of seed cotton, whilst on stream-irrigated land 10 to 12 maunds of 106lbs. of seed cotton are a fair average.

The North-West Frontier cotton is one of the better kinds of Indian cottons, but, unfortunately, the ginning outturn is only 25 per cent.; this defect, however, should be remediable. So far, the Department of Agriculture has not been able to devote much time to cotton seed and plant selection.

The seed used in both the tracts is exactly alike; it is exceptionally small. All the cotton in the Province is sown broadcast; a few grains of maize, for use as green fodder, are mixed with it. The cotton is thinned out only occasionally.

**Damping
Seed
Cotton.**

The great drawback of North-western Frontier cotton (which is appreciated by the spinners and exporters) is that it is heavily damped. The farmers bring in their cotton in string bags (made from palm leaves) on the backs of buffaloes. The cotton is brought into the town early in the morning, when the dew is very heavy; and often the farmer, when passing a stream, will roll the cotton bundles into it. I examined, on the roads, about 50 bags of seed cotton, which were being transported to the ginnery, and not a single bag was dry. I drew the attention of the ginner to the wet condition of the cotton in his compound, and he expressed the wish that Government would devise means of preventing this fraud. The ginner added, that when the farmer puts a stone into the cotton he is able to prosecute him, but that he is powerless when the farmer wets his cotton. On enquiry in the villages I was told that the ginner does not lose through the cotton being wet, as they pay on the weight ascertained in the village prior to sending the cotton to the gin, and the farmers, generally, accuse the ginner of the damping, as it is their men who superintend the carrying of the seed cotton. The cotton which I saw stored by the farmers in their own houses was certainly quite dry.

This wetting of the "kapas" has the serious consequence that the cotton becomes yellow, and quite stale. The ginneries of the Province ought to imitate the example of the Sind factories, where in each ginning compound will be found a concrete platform for the purpose of drying the seed cotton prior to ginning. In the stores of the ginneries in the neighbourhood of Peshawar racecourse, where the sub-soil water comes almost to the surface, the cotton loses its bright colour in consequence of the moisture it attracts from the soil.

Owing to the damage caused through the damping of "kapas," Peshawar cotton has lost greatly in reputation. At the time of my visit there was only one European export firm buying this cotton, and their representative was complaining that the cotton delivered in November was much inferior in class to the cotton that had been forwarded in October. The October cotton came up white and clean, as it was not damped; the farmers, or ginneries, could not damp the cotton in September as the hill streams were dry, but in November, when they were full, the cotton was artificially damped, became yellow and dirty, and consequently the difference in the two shipments was enormous, causing the exporter great trouble. A Government official told me that not a single bundle of "kapas" is brought to the market that is not artificially damped. He once sold some cotton from the Government farm, and, in his presence, the buyer immediately spread it out in the compound of the farm, and began to pour water over it. On being reprimanded, the buyer said he could not otherwise get 400lbs. into each of the string bags. He was prevented from further damping, but he succeeded, nevertheless, in filling the bags with the necessary weight.

Mixing. The North-western Frontier cotton, being longer than the Punjab, is used for mixing, and I was informed on good authority that cotton from the Charsadda district of Peshawar is sent by boats to Nowshera, per canal, and thence by rail to Gujranwalla. There would be no difficulty in putting a stop to this method of cheating and of causing the deterioration of the seed: an ordinance might be issued forbidding the export of unginned cotton from the North-western Frontier Province. A similar step has been taken in Egypt preventing seed cotton from Lower Egypt being brought to Upper Egypt. I am, however, informed that the adoption of such stringent measures would be inadvisable in a country inhabited by the somewhat independent Pathans.

Basin Irrigation. In a village called Pistakara, situated close to the Kyber Pass, in a stream-irrigated tract, I had a most interesting conversation with the cultivators. They all agreed that cotton was their best paying crop. They had picked as much as 16 maunds of 106lbs. of seed cotton per acre, and it was fully 1 inch in length, and white, had a good lustre, and was strong. The land near this village was laid out in terraces, and received, on an average, not more than 13 inches of rain per annum; but the streams carry large quantities of silt down from the hills, which is deposited every year on the fields, and acts as manure. The

farmers took me into their living rooms, where they had the cotton stored away. They were waiting for a rise in price, and told me that they could afford to wait for some time.

The people of the North-western Frontier Province, and also of the Punjab, are decidedly better off than the people in the South, as is evidenced by almost every man and woman wearing jewellery made of gold. The women wear quite an expensive hair decoration, and this is also frequently made of gold. Whilst, until recently, the moneylenders used to handle 80 per cent. of the cotton crop, now only 50 per cent. passes through their hands.

Uniform price for good and bad cotton. The ginner told me that they did not make any difference in the price they pay for any of the cotton, whether it was 1 inch or $\frac{5}{8}$ inch, whether clean or dirty. They pay the same price for all, and they gin all the different kinds together. This is, of course, the reason why the farmers are not induced to pay attention to cultivation. The cotton which I saw in Pistakara village was certainly worth $\frac{1}{2}$ d. per lb. more than the ordinary cotton. The fact is that the ginner either do not realise that, by making various classes, they would get a better price for each lot than by mixing them; or they attempt to pass off the whole as being of the good class.

No Europeans have ginning factories in this Province.

Local market wanted. The North-western Frontier cotton could best be improved by establishing a central market at Peshawar, to which city all the cotton has to be brought. There, the cotton should be graded by Government officials, having due regard to length of fibre, clean picking, and dryness. Three classes should be made, and every sack branded with the class that has been fixed by the grader; after this the cotton should be sold by auction. The difference in class and price alone would be an enormous stimulus to the planters. This arrangement is all the more practicable, as the whole of the crop is but of small dimensions. The same system has been in force for years in Tokar in the Anglo-Egyptian Sudan; and the markets in the Central Provinces have almost the same organisation, with the exception of the grading.

The inadequate supply of carts, and camels, in the district is severely felt in the transporting of cotton. The farmers in the hill stream tracts generally gin their own cotton, the seed of which they store for next season's sowing.

Rotations. The rotation generally followed is :—
 Cotton—sown 15th April, picked September/October.
 Wheat—sown November, harvested in May.
 Jowar (millet)—sown 15th July, harvested 15th October.
 Fallow for six months.

The majority of the cultivators own only half an acre, and they must, naturally, give preference to food crops.

Freight. The charges on cotton from Peshawar to Kiamari, the port of Karachi, work out at Rs. 3 per maund of 82lbs. This includes loss of weight in transit owing to damp-

ing, and the exorbitant price of pressing, Rs. 5 per bale of 5 maunds (in Amritsar only Rs. 2 are charged for pressing).

The rate of carriage on cotton from Peshawar to Karachi is Rs. 1-5-0 per maund.

Cultivation. The following information I received from an important ginner in Peshawar :—

Preparation of the land.—The usual date for preparing the soil, prior to sowing, is the beginning of March; sowing begins in the middle of April, and is generally completed by the 20th May; no fertilisers or manures are used.

The valley of Peshawar.—Almost the whole of the cotton-producing land, which is extending every year, is irrigated by a number of canals, natural and artificial; the silt brought by the canals acts as a natural fertiliser. It is due to this beneficial silt that the Peshawar valley is famous for its fruit production.

The rainfall is almost nil during the months of the monsoon.

KABUL COTTON.

Of this most excellent cotton about 300 bales of hand-ginned are brought in yearly from Kabul (Afghanistan), along with 300 bales of seed cotton. All of it is sent to Bombay cotton mills, as the exporting firms are not willing to pay satisfactory prices. It is a superior kind, equal to Cambodia cotton, without any stain or leaf. It is sold in Bombay at Rs. 10 to Rs. 15 per kandy of 784lbs. above the price of American Middling.

Ningrar cotton is a variety of Kabul cotton, which is slightly better in colour. About 500 bales of this cotton are received annually from the lower province of Afghanistan and Ningrar.

Khyber cotton is the best variety of Peshawar cotton, and is picked without leaf or stained cotton. There are only about 500 bales grown.

The ginning outturn of the North-western Province cotton is only 24 to 25 per cent., the seed is quite bare.

Statistics for the last 6 years, in bales of 400lbs. :—

Statistics.	Year.	Acreage.	Bales.
	1908-9	15,200	4,900
	1909-10	20,400	6,400
	1910-11	22,700	7,100
	1911-12	28,400	9,300
	1912-13	34,500	11,400
	1913-14	40,400	12,900 (estimated).

Government Farm. The Government farm is situated about 10 miles East of Peshawar. It comprises 100 acres, and was started in 1910. The irrigation water is supplied by the Kurvi branch of the Kabul River Canal. The Department is devoting special attention to fruit cultivation, peaches in particular, but various kinds of cotton are being experimented with. The Cambodia cotton on the farm was about 10 feet high, and it evidently received too much water. The farm is not situated in the cotton-growing tract, but a new farm will be started at Dera Ismail

Khan, the best cotton-growing tract. The cotton crop is developing in the Province comparatively quickly, and the intention of starting the new farm at Dera Ismail Khan, which is a more suitable district, deserves to be mentioned. I am convinced that with due attention to seed and plant selection the ginning outturn, which is exceptionally low, could be increased. Perhaps the services of a Botanist might be of use. The farm has been excellently laid out by Mr. R.



Students in the Planet Junior Hand Hoe Competition at an agricultural show in the North West Frontier Province.

Robertson Brown, and the fruit experiments do him great credit. The farm has a racecourse, where the farmers congregate now and then to devote themselves to sports, such as tent-pegging, racing, &c., of which they are very fond. This is one way in which to attract the cultivators to the demonstration farm, and to teach them improved methods.

The cotton prospects in this Province are decidedly bright.

UNITED PROVINCES OF AGRA AND OUDH.

The Province may be divided into four distinct tracts of country, viz. : (1) Portions of the Himalayas, (2) Sub-Himalayan tracts, (3) the great Gangetic plain, and (4) portion of the Vindhya and Eastern Satpuras. More than half the total area of the province is included in the great Indo-Gangetic plain. The Doab, or tract between the Jumna and the Ganges, a gently sloping plain of alluvial soil, includes the most prosperous part of the Province and is protected by canals. The eastern portions have the heavier rainfall and are most densely populated.

British Bundelkhand, which adjoins the Central Provinces, belongs to the United Provinces, although in climate, soil, and people it more resembles the Central Provinces.

Irrigation. The main productive canals of the United Provinces irrigate the area between the Ganges and the Jumna, the Ganges and Lower Ganges Canals, with 520 and 665 miles of main canal respectively, being the largest works. The smaller Eastern Jumna Canal is the most remunerative, having throughout the last decade yielded a net revenue of from 20 to 25 per cent. on the capital outlay. The Mat branch of the Ganges Canal, opened in 1903, effected a great improvement in the condition of the dry tract in Aligarh and Muttra, and the Fatehpur-Sikri extension of the Agra Canal, completed in 1910, protects one of the tracts of the Agra district, formerly subject to famine. South of the Jumna, in Bundelkhand, where the Betwa Canal was, in 1902, the only protective work in the Province, some important new protective works have been undertaken, among them the Ken Canal, opened in 1907, and the Dhasan Canal, opened in 1910. As a result the trans-Jumna districts of the province, which were previously so liable to famine, are now fairly well protected. Attention has also been given to the restoration of tanks in Bundelkhand.

Area under Cotton. More than $1\frac{1}{2}$ million acres were grown last season with cotton, yielding 482,000 bales.

The United Provinces produce now almost 10 per cent. of the total crop of India.

These Provinces are divided, for cotton purposes, into a western district, with its centre round Aligarh, and a southern district, with Cawnpore as its centre.

ALIGARH.

Land Tenure. There are small holders of land of, say, 10 acres who cultivate their holdings themselves, but there are also large landowners who have tenants. These must be divided into two classes, viz. :—

- (a) Permanent-right tenants,
- (b) Tenants at will ;

the latter can be ejected at any time, but the former are tenants for life.

The landlord pays half of the rent he receives to the Government as assessment; the rent varies from Rs. 3 to 3-12-0 per acre, the water used for the canals is paid for separately, the rate for cotton is about Rs. 2-8-0 per acre. Each kind of crop has a different water-tax.

The soil is loamy.

Kinds of Cotton : The kind of cotton which is generally grown in the United Provinces is the ordinary Bengal (*G. Neglectum*).
White Flowering It is very short, $\frac{1}{2}$ to $\frac{5}{8}$ inch in length. Its value to the farmers depends entirely on the ginning out-turn, which is generally about 33 per cent. In my previous report I mentioned that Dr. Parr, the Deputy-Director of the Western Circle, had been able to obtain, through careful selection, a strain of a "roseum" cotton, known as white-flowering Aligarh, that has a ginning out-turn of 39 to 40 per cent. I am pleased to be able to report that this high percentage has been maintained, and that during last season the area grown with this improved seed was 20,000 acres, yielding on an average 10 maunds of 80lbs. of seed cotton per acre. This great increase in the acreage (2,500 acres in 1911) is solely due to the foresight of the Provincial Government, which authorised the Deputy-Director to purchase large quantities of seed cotton which had been raised by the farmers from the special seed originally given out by the Government. The Deputy-Director buys this cotton at a premium and has it ginned under special supervision at a ginnery in Aligarh. This year the Department will have sufficient seed for 40,000 acres to distribute amongst the farmers, and it is estimated that the cultivators have saved amongst themselves an equal quantity of this improved seed. The white-flowering Aligarh cotton gives, on a conservative estimate, an additional profit to the cultivator of Rs. 15 per acre more than the ordinary local (Deshi) cotton. We may assume that in the coming season some 80,000 acres will be sown with this improved seed, representing an annual additional income to the farmers of the district of at least Rs. 1,200,000. This is a clear proof of the wisdom of the Government in employing European agricultural experts.

The farmers, as I could see for myself at our meetings, were most anxious to obtain seed from the Department. It is estimated that in the Western Circle 750,000 acres will be producing white-flowering Aligarh in a few years, as soon as sufficient seed is available. There is no doubt that this variety has passed out of the experimental stage. It has made a reputation and is forging ahead.

Although the Government has acted wisely in buying back large quantities of seed cotton, yet I think it has not gone far enough, for at present the seed cotton is ginned at a public ginnery. When I visited the gin I was able to appreciate the difficulty of keeping this seed cotton quite separate, when seed cotton of other kinds is being ginned at the same factory.

Department should own a Ginnery. It must be borne in mind that at the ginning season very little space is available in the factory compounds, and after calculating the expenses for ginning, and considering the danger of mixing I feel convinced that it would pay the Department of Agriculture to erect a small ginnery, or to hire one entirely for the season. The cost of

ginning the seed cotton by the Department at Aligarh is about Rs. 8,000 the season, whilst the entire expenditure on an up-to-date ginning factory, such as has been recently erected in Mirpukhas by the Bombay Cotton Syndicate, would amount to Rs. 45,000. It is certain that this work will develop. Such a ginning factory, owned by the Department, would serve as a demonstration of labour-saving appliances, and would act as a stimulus to the owners of other ginneries to improve their somewhat primitive plant.

The practice of growing cotton mixed with other crops is slowly giving way to pure cultivation. One of the usual mixtures with cotton, in the United Provinces, and in many other parts of India, is *cajanus indicus* (pigeon pea). It is here grown in lines about 10 feet apart. It is true this plant is nitrogenous, but as it frequently grows 5 to 6 feet high, the intervening cotton is shaded. It is grown principally with the object of ensuring the success of *one* field crop. With

**Mixed
Cultivation
Disappearing.**



Sowing by hand.

the high price of cotton, however, every available space is being devoted more and more to the cultivation of cotton.

Cotton in the Western Circle is largely grown as an irrigation crop, and it is interesting to note that, owing to the introduction by the Department of Agriculture of a high-yielding variety, villages are now beginning to grow cotton under well-irrigation. Owing to the high price which cotton brings the number of wells has considerably increased. These wells are not only of great assistance in the cultivation of cotton, but they secure whole districts against famine.

**Increase in
Number of
Wells.**

About 13 miles out of Aligarh I visited a seed farm which Mr. H. M. Leake, the economic botanist, has started recently for the purpose of testing, under field cultivation, some of the strains of cotton raised by him on the Mendelian system.

**Leake's Seed
Farm.**

Plant breeding has undoubtedly made considerable progress during the last 10 years since the re-discovery of Mendel's work. The two botanists who have achieved great results with the cotton plant, by the adoption of the Mendelian system, are Mr. H. M. Leake, M.A., of Cawnpore, and Mr. W. Lawrence Balls, M.A., until recently of Cairo. The fundamental idea of this new line of work is that the form of a plant is decided by the presence or absence of definite units or characters. In hybridisation work, when one plant possessing a particular character is crossed with another lacking that character, there will appear in the second generation plants, some of which will possess and some lack that character, and from these it is possible to breed with confidence two pure races which will remain pure—one possessing and the other lacking the character in question. Now suppose there are two plants, one possessing a desirable character lacking in the second, while the second possesses a desirable character absent in the first; in the second generation of the cross between these two (in the absence of "coupling") four types of plants will be found. Two of these will possess one of the desirable characters and lack the other—these are the two parental forms. The other two are new types, and of these one will possess both desirable characters while the other will lack both. It will also be possible to raise all four types obtained from the cross in a pure condition.

Such, in its simplest form, is the method of improving races of economic plants which recent discovery has rendered possible. As applied to cotton it will be understood that, given, for instance, a long stapled race but late flowering, and a short stapled race which is early flowering, it is possible to isolate a pure long stapled early-flowering race. It is not meant to convey the idea that the process is in all cases as simple as above stated (difficulty arises in determining what actually constitutes a unit character), but, in the absence of "coupling"—and it may be noted that "coupling" has not been found to occur in any of the essential characters of the cotton plant—it is possible to isolate races possessing a series of desirable characters such as is possessed by no race at the present time. Further, a race so produced will prove as constant as any of the races now found in cultivation.

Mr. Leake has crossed some of his selected strains with a red flower, because he will then be able to distinguish easily when a cultivator has mixed the seed with other kinds, as the cotton generally grown in the United Provinces has a yellow flower.

I was specially interested in five varieties that I saw on this farm, which promised excellent results: Sanguinium 474, Type 7, Cawnpore 79, Cawnpore 642, A.L. 5. Some of these are, perhaps, so far, not ripening early enough, but this drawback will probably be overcome by plant selection.

Two years ago, when the land for this farm was taken over by compulsory purchase, the cultivators of the district were very much annoyed, and the Department had to take possession of the land with an armed guard.

On the occasion of my visit I met several farmers, and two of them specially acknowledged the great benefits they had received since they had come into closer contact with the Agricultural Department. These men had grown Aligarh white-flowering cotton, and

were full of its praises. They had heard of the services rendered by the International Federation, and expressed their appreciation of the work undertaken.

These men unhesitatingly acknowledged that cotton was the most remunerative crop to them, and they supplied me with the following detailed calculation. It must be clearly understood that the figures refer only to the very best land in the western district :—

(Land in use over 7 months.)

	One ploughing.....	Rs. 1 4 0
Cost of Cotton	Seed	0 8 0
Cultivation	Irrigation rates	3 8 0
per Acre.	Labour in connection with irrigation ..	1 8 0
	Weeding	5 0 0
Picking		5 0 0
Rent to zemindar at Rs. 10-0-0 per annum.....		6 0 0
		<hr/>
		Rs. 22 12 0

Crop, 10 maunds, sold at Rs. 8 = Rs. 80. Nett profit, Rs. 57-4-0 per acre.

As in some districts the Government, in view of the increasing imports of sugar from Java, seems of late inclined to push the cultivation of sugar cane, the following calculation is of interest :—

(Land in use 18 months.)

	Five ploughings at Rs. 4	Rs. 20 0 0
Cost of	Seed	10 0 0
Cultivating	Manuring	15 0 0
Sugar Cane	Labour—irrigation	4 0 0
on 1 Acre.	Irrigation rates	5 10 0
	Weeding	10 0 0
Cutting, Pressing, &c.		40 0 0
Rent at Rs. 10-0-0 per annum (1½ years)		15 0 0
		<hr/>
		Rs. 119 10 0

Crop = 40 maunds at Rs. 3-8-0 = Rs. 140. Nett profit Rs. 20-6-0 per acre only; but it must be taken into consideration that the growing of sugar cane gives employment when there is little other agricultural work to be done.

(Land in use 5½ months)

	Ploughing	Rs. 10 0 0
Cost of Wheat	Irrigation tax	3 8 0
Cultivation,	Seed	3 0 0
1 Acre.	Manure	5 0 0
	Labour—irrigation	4 0 0
Weeding.....		2 0 0
Harvesting (cutting, threshing, winnowing)		20 0 0
Rent (5½ months)		5 0 0
		<hr/>
		Rs. 52 8 0

Crop, 20 maunds at Rs. 3-0-0 at 82lbs., Rs. 60; straw, Rs. 10 = Rs. 70. Nett profit, Rs. 17-8-0.

Maize leaves about Rs. 20 nett profit per acre. Only the best land will grow maize.

Cotton Cultivation.

The sowing season is in May on irrigated land, and in June with a rainfall on unirrigated land; the soil is extremely hard at this time of the year; in fact, it would be impossible for the steel plough to enter it. The cultivator floods his field to soften the ground, and allows it to dry sufficiently to permit the native wooden plough to enter the soil. After watering the field he sows the seed broadcast, then ploughs it in and rolls it, as is done in the Punjab; watering and hand-weeding are carefully performed. It is the general opinion of the cultivators that too much preparation of the soil is no advantage as regards the yield of the crop, and therefore he leaves his field fallow during the winter season, during which time the roots and short stalks of the previous crop are left in the ground. The soil even at the beginning of winter is so hard that one cannot pull up the roots.

Many cultivators in the district gin sufficient cotton with a native hand-gin, "Churka," to enable them to sow their fields with the seed thus obtained. This is said to be an advantage, as the power gins often cut the seed and thus destroy its germinating power.

Picking begins in October and lasts until the end of December; the first and last pickings are considered inferior in quality and yield to the middle pickings.

After the picking has been finished the cattle are allowed to graze on the cotton fields.

Manure.

During the dry season, October to May, the cattle manure is made into cakes, dried in the sun and afterwards used for fuel, but during the remaining few months this is impossible owing to the rains. During that short time the manure is collected into heaps and used for the preparation of maize and sugar-cane soils. No manure is used for preparing the cotton soil, which benefits solely from the residue of manure that was given to the preceding crop.

Rotation of Crops.

The following may be considered as representative on irrigated land; it has the disadvantage, however, of there being too few leguminous crops:—

Wheat, 6 months.

Cotton, 8 months.

Barley and peas (mixed), 4 months.

Maize, wheat, &c., 6 months.

On unirrigated land cotton, jowar (millet), and Raha (a kind of pea), are often grown mixed.

"Buri" Cotton. Successful Experiments.

Dr. Parr has, during the last three years, grown Buri cotton from the Central Provinces on the Government experimental farms. He has carefully selected plants, especially as regards their early ripening tendency, as this must be an essential feature of any cotton in the United Provinces, owing to the early frosts. As the result of this work of selection, a type has now been obtained, the growing period of which makes it suitable for cultivation in the Western Circle. Such seed as was available was distributed to selected Zemindars early in 1913, and I inspected a field of this Buri cotton at the village of Mahmudpur. This field looked in excellent con-

dition, the branching habits of the plants and the prolific yield were specially noteworthy. The owner said that had he grown ordinary Deshi cotton on this particular plot, he could not have expected more than 10 maunds of 82lbs. of seed cotton per acre, but that this Buri cotton had given him 15 maunds. He said that even if he could not get a better price for his Buri cotton than for the ordinary Deshi, he would extend Buri as much as possible. As Buri continues yielding until a later period than Deshi, the cultivator must be prepared to forego his sowing of late barley, which he usually plants in this district after the local cotton, but the nett loss from this cannot be more than Rs. 10 per acre, which is, of course, more than balanced by the additional yield of five maunds of Buri seed cotton. All the seed that is available for next year's sowing has already been applied for by the good cultivators of the district; it is probable that 300 acres round Aligarh will be sown with Buri next season. The extension during the next few years will depend upon the quantity of seed cotton which the Deputy-Director is allowed to purchase. It is to be hoped that the Agricultural Department will enable him to buy and gin this crop on a large scale.

The fibre is strong, approximately of the same length as Middling American; in short, there is no reason why this Buri should not replace low Middling American in spinning mills round Cawnpore. The ginning outturn is 34 per cent., and in view of the higher yield (not as garden, but under field cultivation) and of the good ginning outturn, there is every reason to expect that this kind of cotton will be able to compete with the improved Deshi cotton that has recently been introduced by the Department.

Some years ago American cotton of 1 inch staple was grown in the district of Aligarh and sold at the price ruling for American Middling, but in spite of this, the cultivation of American cotton was not remunerative enough to the farmer. The difference in price between American and the local Bengal cotton did not prove sufficiently high, as the yield per acre was not great and the ginning outturn was below 32 per cent. Another drawback was that the American cotton was grown round separate villages, and had to be collected, causing considerable extra expense. The Agricultural Department and the cultivators, after full confirmation of the reduced profit derivable from the cultivation of this cotton, have definitely given it up. They are now concentrating their attention upon the white-flowering Aligarh, and upon the Buri cotton mentioned in the previous paragraph. This American cotton was cultivated to a small extent in a few places, and I saw in one field that, owing to the drought of last season, the growth was very stunted and the crop very small, whilst the Buri cotton of the same district seemed to have withstood the drought very well.

One of the owners of a ginning factory complained very much of the watering of kapas (seed cotton) from Kasganj. In that locality some 10,000 bales are ginned, and about 75 per cent. of these are brought into the factories in a damp state. According to the information I was able to obtain, the practice is on the increase, and as much as 20 per cent. of water is said to be added; in fact, Kasganj has such a bad

Damping of Kapas.

reputation that dealers in this cotton are careful that the bales do not show any trace of having come from that place. Although the buyers habitually deduct allowances for damp, yet the farmers, owing to their inborn gambling instinct, do not take steps to remedy the evil. I visited Kasganj and found plenty of damp cotton in the compounds of ginning factories, but the buyers acting for the big export houses assured me that the only way by which water gets on the seed cotton is, that it is picked whilst the dew is on the fields and that the cotton is picked every morning, whilst in other tracts of the province it is usual to pick only every fifth day.

Ginneries. The ginneries are mostly in the hands of native firms; they are all roller gins, single and double action. As the cotton is picked in a dirty condition it is customary in practically all the provinces to pass the cotton through an opener before ginning it. In this district proper export bales are pressed at once, i.e., without first making the loose bales as is the custom in Sind and the Punjab. Ginning factories work, generally, three days, and the cotton ginned during that time is pressed on the fourth



Primitive method of conveying cotton bales from store to ginning factory.

day. To a fairly large extent the ginnerers buy the cotton from the "bania," but those who gin on commission charge 7as. per 82lbs. seed-cotton, and about Rs. 3 per bale for pressing. The wages of the men at the press are 6as., those of the women at the gins 4as.

The work in the ginning factories at Aligarh is carried out very carefully, all the European export firms employing a number of hands for the purpose of picking out the stained cotton and drying the seed-cotton in the sun. It is almost incomprehensible how few labour-saving appliances there are in these factories, although some are managed by Europeans. The cotton stores are often 200 and 300 yards away from the ginning factory, and the bales are carried on the backs of natives from the store to the front of the factory, where they are wound up by hand. If one considers, however, that the wages

of the labourers carrying the bales are only 4 annas per day, one will understand that the introduction of labour-saving appliances must be slow.

Increase in Cotton Production. The cotton production of the Aligarh district is expected to reach 25,000 bales this year, against 12,300 last year. This year all the cotton has been grown under irrigation, and if there had been the normal rain in July, August, and September, the cotton production of the district would have reached 50,000 bales. Hatras, the most important cotton market of the Western Circle, has suffered severely this year from drought, and had it not been for the opening of a new canal in this district a severe calamity would have befallen it.

Seed Distribution. At present the system adopted by the Department of Agriculture is as follows: The seed of the white-flowering Aligarh cotton is grown on 20 acres on each of the Aligarh, Kalai, Muttra, and Agra Government farms. This area provides sufficient seed annually for 1,600 acres, and may be looked upon as the last line of defence. The seed is distributed to selected villages, which agree to grow the entire cotton area at their disposal with this variety only. The cotton crop from these particularly selected villages is bought back by the Deputy-Director of Agriculture, and the seed representing the second line of defence is distributed in the following year and suffices to sow an area of 32,000 acres. It is evident that the Department has the absolute control of the seed in the first year, not so in the second. It would be an improvement on the system if the Co-operative Credit Societies were to take up this question of controlling those cultivators who receive the seed. It is evident that 80 acres are not at all sufficient to bring about the ample seed distribution which is desired. If the seed farms are larger, then they could be worked without a loss.

Scope for Commercial Firms to take up Seed Raising. Seed distribution is bound to become, before long, a work that will occupy a great deal of the time of the staff of the Agricultural Department, and if the Government will assist, I do not see any reason why commercial firms who make a speciality of the raising and distribution of seeds, should not undertake this work. - This could be done profitably in India, and it would release the staff of the Department of Agriculture for other work.

CAWNPORE.

Satisfactory Improvement in Department. Four new demonstration farms were opened during the last year in the cotton-growing tracts, and it is hoped that four more will be provided in the coming season.

Whilst I had occasion in my two previous reports to criticise somewhat unfavourably the work of the Department of Agriculture of these Provinces at Cawnpore, it is a very pleasing duty to be able to report that a decided change for the better has taken place. The new Director of Agriculture seems to have stirred up an enthusiasm amongst the officials; and cotton is certainly receiving much more

The cost per acre (in rupees and annas) of cultivating the principal crops with water from the Western Jumna Canal is given in the following table :—

	Seed.	Ploughing and Sowing.	"God" Inter-cultivation.	Weeding and Watering.	Harvesting.	Manure.	Miscellaneous.	Total.	Water Rates on Western Jumna Canal.			Total.		Average Out-turn Good Crop.	
									Flow.	Lift.	Flow.	Flow.	Lift.	Grain.	Straw (bhusa).
Wheat	Seers 25/30	Cost 2/-	8/-	—	5/-	9/-	—	24/-	4/-	2/8	28/-	26/8	12	12	
Gram	20 maunds	1/2	3/14	—	2/-	4/-	—	11/-	2/8	1/8	13/8	12/8	10	12	
Sugar	30 seers	12/-	16/-	15/-	10/-	15/-	10/-	98/-	9/-	6/-	107/-	104/-	30	—	
Cotton	7 seers	1/-	6/8	8/-	6/-	8/-	—	29/8	4/-	2/8	33/8	32/-	7	—	
Rice	20	2/8	6/8	5/-	5/-	6/-	—	25/-	6/8	4/-	31/8	29/-	18	36 parali	
Jowar	8	1/8	4/-	—	5/-	3/8	—	14/-	2/8	1/8	16/8	15/8	5	40	
Bajra	4	4/-	3/-	—	5/-	3/8	—	11/12	2/8	1/8	14/4	13/8	5	40	

Other Kharif crops 16/8 per acre.

Other Rabi crops 19/- per acre.

attention than in the past. Several new cotton farms have been started and the condition of the work undertaken speaks well for the staff.

**Kinds of
Cotton :
Bengal.**

The ordinary cotton grown is the same as in the Western Circle, the Bengal cotton. Sowing in the Cawnpore tract begins towards the end of May on irrigated land, otherwise the farmer has to wait until the break of the monsoon, which generally arrives about the 15th of June. Picking begins about October 1st.

**Cawnpore
American.**

American cotton was introduced some 25 years ago into the United Provinces, and in my first report, 1910, I mentioned the high opinion held by some Calcutta spinners of the value of this cotton. The cultivation was only feasible by the Government undertaking to collect this cotton and to purchase it from the cultivators. On the plea that this was interfering with legitimate trade, this necessary and useful work of purchasing the small quantities of cotton was stopped by the Provincial Government, and caused the entire collapse of the cultivation of American cotton. I am pleased to be able to report that in 1912 through the assistance of the Elgin Mills, Cawnpore, which advanced money and guaranteed a premium over the price of the ordinary cotton, a revival has taken place. Only a few cultivators had continued to grow small patches of this American cotton during the years that had intervened, and, in consequence, practically the whole of the work has to be commenced afresh. Now 900 cultivators in the Cawnpore district are growing this Cawnpore American variety on small areas, the average yield of which has been, during the season just ended, 8 maunds of 82lbs. seed cotton. The total area sown with this variety was 350 acres in Cawnpore and 100 acres in adjoining tracts, all under irrigation.

An enterprising Indian has, with the help from the Takavi fund, started a ginnery for the special purpose of ginning the cotton from the cultivators who are growing this American variety. His charge is somewhat high, viz., Annas 8 per maund, but the Department has the assurance that a mixture is almost impossible; at present the factory has 9 gins, but in the coming season the plant will be enlarged.

The Department has this year sufficient seed of the Cawnpore American variety to plant 8,000 acres. Its cultivation will result in an additional net profit of fully Rs. 10 per acre over and above the profit made generally with ordinary cotton.

On the Government farm near Cawnpore 24 acres of this American cotton are being grown. The highest outturn of this plot was 14.6 maunds per acre, and the lowest 7.7, the ginning outturn being maintained between 31 and 32 per cent.

Spinning tests. The following report from the Elgin Mill Company shows the comparative merits of imported American and Cawnpore American :—

imported	Nett weight of cotton tested, 3,191lbs.
American.	Waste made in blow-room, 5.6 per cent.

COMPARATIVE WRAPPINGS OF TWIST FROM RINGS.

Real American (Imported at 20 points
on Middling.)

Wrappings.	Test.
24.09s ..	55½lbs.

Cawnpore American.

Wrappings.	Test.
23.52s ..	59½lbs.

COMPARATIVE WRAPPINGS OF WEFT FROM MULES.

Real American (Imported at 20 points
on Middling).

Wrappings.	Test.
35.71s ..	24½lbs.

Cawnpore American.

Wrappings.	Test.
34.48s ..	26½lbs.

NOTE.—The spinning tests were taken on the same machines, which, being new, are all in good order, and the wrapping tests for strength were taken at the same time, namely, warp 10 a.m., weft 2 p.m. The testing machine being power driven is accurate for all. The wrappings were taken one at a time, at the same tension, and from a similar part of cop or bobbin. In fact every care was taken to ensure accuracy.

Aligarh white flower in Cawnpore. The Aligarh white-flowering cotton is being grown on 17 acres, and its maximum yield at Cawnpore was 12.6 maunds, its lowest 6.3; ginning outturn varied from 39 to 40 per cent.

BUNDELKHAND.

Bundelkhand and adjoining tracts have an area of about 7 million acres. At one time this was a cotton-producing tract, but at the present only 90,000 acres are under cotton, whilst in 1914 160,000 acres were planted with cotton. This falling off is all the more noticeable, as in all other districts of the United Provinces, the acreage under cotton has increased. I am assured that the Department of Agriculture could easily re-establish cotton in this large tract by introducing an early maturing variety, such as No. 7, grown by Mr. Leake, and as in the last decade three large canal systems have come into existence, the cultivation of cotton will be more profitable now than it used to be. There are two Government farms in Bundelkhand with an active staff. These farms are at present under the Direction of the Agricultural Expert stationed at Cawnpore, who feels he cannot do justice to the work in Bundelkhand. Soil, climate, and people are quite different from the Cawnpore district, and for Government Administrative purposes it forms already a separate unit. In Bundelkhand the soil is black, more like the black cotton soil of the neighbouring Central Provinces, whilst the Cawnpore tract has alluvial loamy soil washed down from the Himalayas. In the past season Bundelkhand has grown 3,000 acres of the ordinary Bengal cotton, the first time under irrigation, from seed supplied by the Department of Agriculture. The cultivators are said to accept readily the advice of the European agricultural adviser. There are therefore in this tract all the fundamental conditions needful for an active agricultural expert with a special view to fostering cotton growing. His work would be beneficial both to the cultivator and to the millowners of Cawnpore in particular. The third Deputy-

Director, who has recently been engaged for the United Provinces, is to devote his entire attention to sugar cane and rice; and it is only fair to the cotton industry to ask that another expert should be engaged for the promising tract of Bundelkhand, not with the purpose of devoting himself entirely to cotton, but to give it his main attention. It is admitted by every agricultural expert that the extension of cotton cultivation is much sounder economically than the extension of sugar cane, in which crop the United Provinces can probably never expect to compete with Java.

Wheat is also a very important crop for Bundelkhand, and this would of course come in as a rotation crop with cotton.

The early maturing cotton variety No. 7, mentioned above, was sown on July 20th, and the first pickings took place on October 1st, practically a nine weeks' crop. The yield at Cawnpore was $8\frac{3}{4}$ maunds per acre, whilst at Bundelkhand it reached 9 maunds. An earlier result was obtained by planting on the 7th and 8th June, and the first pickings were in that case taken on September 1st, the second on October 7th. No. 7 type is a very hardy plant, and it has remained true for seven years.

The Upper India Chamber of Commerce at Cawnpore, which has at all times taken a keen interest in the promotion of cotton growing, adopted, at a meeting at which I was giving a report on my visit, a resolution urging upon the Government the appointment of a Deputy-Director for this district.

The Department has recently undertaken experiments in cotton growing in the submontane district of the Province at a place called Kashipur. The cotton grew exceedingly well on the sloping land, where there was no fear of water logging. The amount of weeding required, however, was so great, and the cost was so high that the cultivators did not take kindly to it.

**American
Presbyterian
Mission
as promoter
of Cotton
cultivation.**

The American Presbyterian Mission has amongst its staff an agricultural expert who, in the neighbourhood of Allahabad, is undertaking some very useful experiments in cotton growing. He is also introducing modern implements, and from reports I have received the Oliver plough seems to have made quite a reputation.

**Future
extension.**

The growing of cotton on non-irrigated tracts depends entirely upon the arrival of the rains. If they are late, cultivators have not been able to sow cotton, but with the introduction of a rapidly growing and maturing variety such as No. 7, this has been changed. The Director of Agriculture gave it as his opinion that if prices of cotton remain on the present level the acreage under cotton in the United Provinces would shortly reach 2,000,000 acres; it is now $1\frac{1}{2}$ millions.

A very extensive increase in the cotton crop of the United Provinces will take place as soon as the Sarda canal is constructed, but this project must, I fear, be placed in the same category as the Rohri canal of Sind, which has been under consideration by the Government for about 50 years.

CENTRAL PROVINCES AND BERAR.

The Central Provinces comprise the broad belt of hill and plateau country between the Gangetic Plain and the Deccan. Berar was leased in perpetuity to the British Government in 1902 by the Nizam of Hyderabad, although for many years before it had been under British rule. The total area covered by these Provinces is 100,000 square miles, and the population is about 14,000,000, there being 139 persons to the square mile. The Central Provinces and Berar are the second largest cotton-growing districts of India, contributing one-fifth of the entire crop. The area at present under cotton is 4,715,000 acres. Since 1902 the cotton acreage has increased by almost 900,000 acres. The combined province may be divided from north-west to south-east into three tracts of upland, alternating with two of plain country. In the north-west two districts lie on the Vindhyan or Malwa plateau; the surface of the country is undulating, and broken by frequent low hills covered with a growth of poor and stunted forest. South of this plateau comes the long and narrow valley of the Nerbudda, with deep alluvial deposits of extreme richness, excellently suited to the growth of wheat. South of the valley, the Satpura range or third division stretches across the province. The fourth geographical division, the plain of Berar, Nagpur, and Chhattisgarh, extends along the southern and eastern faces of the Satpura range. In the west the Plain of Berar and Nagpur contains the rich black soil that makes the area the great cotton-growing tract of the province; further east the Wainganga basin receives a heavier rainfall, and is mainly a rice-growing tract; and further east still, beyond a belt of hilly country, lies the great plain of Chhattisgarh, with small embanked rice-fields, separated by ridges of uncultivable gravel. South of these level tracts lie two expanses of hill and plateau. In the west the rugged hills of the Ajanta range form the southern portion of Berar. In the east lies the vast area of hill and jungle comprised in the Chanda and Chhattisgarh Zamindaris and the Bastar and Kanker Feudatory States.

Latterly the Central Provinces have been very fortunate as regards the rainfall. It is only recently—in 1896/7, and again in 1899/1900—that the rains failed absolutely, and the famines resulting from these rain failures were the first reason for the construction of State irrigation works. At the same time cultivators were induced to construct new tanks (reservoirs), to improve old ones, half the cost being, generally, paid by the State. The cultivators of the Central Provinces had therefore to become accustomed to the new method of cultivation by means of irrigation. The area served at the present time by irrigation is only about 30,000 acres, but this will be doubled by the construction of the Asola Menda tank, which will, when completed, irrigate 60,000 acres. Another tank in the Nagpur district commanding 50,000 acres will soon be completed. Several canals, estimated to irrigate 700,000 acres, are projected—these are the Tandula, Mahanadi, and the Wainganga canals.

The Central Provinces are divided for cotton-growing purposes into the Eastern and the Western. The Eastern portion includes the Berar and Nagpur division, under the charge of the Deputy-Director, Mr. D. Clouston, stationed at Nagpur; and the Western, called the Nimar District, includes the western parts of Hoshangabad, adjoining Nimar, and Sausar Tahsil of Chhindwara, adjoining Nagpur, and is under the charge of Mr. G. Evans, Deputy-Director of Agriculture, Jubbulpore.

**Eastern
Circle.**

By far the most important cotton area is in the Berar and Nagpur division. The rainfall varies from 26 to 46 inches, the average, over part of Berar, where the largest crop is produced, is as low as 30 inches. Where the rainfall exceeds 46 inches the crop is more precarious. In June, when the seed is sown, the normal temperature is 114° F., but when the rain breaks it falls considerably, reaching 70° in February, when the last pickings are made. The area which is planted annually under cotton is dependent entirely on the rains; if they are excessive at the time of sowing, or just after sowing, the area is reduced, because where the rains have injured the young plants, Jowar is sown. Cotton suffers less from excessive drought than any other crop, and it is not uncommon for a fairly good cotton crop to be obtained even in a famine year. This is the experience also in the United Provinces, where there is a proverb to the effect that "a famine year means a good cotton year." The nature of the soil is clayey loam, known as black cotton soil, on most of the area.

**Department
of Agriculture.**

In my previous report I spoke of the excellent organisation of the Department of Agriculture of these Provinces, and I have every reason to confirm my statement. In no Province of the Indian Empire is there such an efficient Department of Agriculture, due largely to the long period during which the Director of Agriculture, Mr. C. E. Low, C.I.E., I.C.S., has been in charge. In the other Provinces the post of Director of Agriculture frequently changes. This has not been the case in the Central Provinces, with the result that the official in charge has obtained a thorough knowledge of all the questions relating to his position. The friendly, yet businesslike, understanding between the Director and his Deputy-Director no doubt contributes largely to the excellent results obtained.

There are no Indian officers in the Central Provinces who show any signs of being able to fill, at any time, the posts of Deputy-Directors. With strict supervision they are able to look after the farms. The Agricultural College at Nagpur evidently does not get the right class of men—sons of cultivators—to attend, and there seems to be no hope of the College ever turning out Indians capable of occupying the higher posts in the Department of Agriculture. There are certainly natives to be found capable of undertaking the work of agricultural teachers, but even there the teaching is apt to be "bookish" and not sufficiently practical. A new Deputy-Director of Agriculture has been sent recently to the Central Provinces, and he is at present undergoing a kind of apprenticeship. It was thought that 3 Deputy-Directors and 3 Assistants would be all that were needed, but owing to the great development in the seed

supply of cotton and wheat, to the improved prospects of sugar cane, and to the distribution of improved implements, it is becoming evident that the European staff is not sufficient.

Seed

Distribution.

The system of seed distribution adopted in the Central Provinces is no doubt responsible for the increasing crop, for not only has the improved seed been the cause of an increased yield, but it has also stimulated the farmer to grow, more extensively, a crop that gives him a better return. The Government possesses two central Government farms, from which selected seed is supplied every year to a number of seed farms. During the last season 120 of these were in existence. The method of establishing and working these seed farms is the following : Leading landholders, who are also members of Agricultural Associations, were in the first instance selected by the Director of Agriculture as suitable men to manage the seed farms, and at the beginning Government guaranteed to make up to these men any loss resulting from the introduction of the improved methods of cultivation which the Department recommended in working the farms. There has not been, of course, a single case where any loss has been sustained ; and during the last few years the demand from the cultivators for an extension of this system of seed farms has become stronger. These 120 seed farms occupy land that is owned by the cultivators, not by the State. The seed farms have been combined this year into 25 unions, each consisting of a central seed farm and of from 6 to 10 branch seed farms. In this way some millions of pounds of Rosea cotton seed are distributed annually.

From conversation with the officials of the Department I have gathered that it would be quite safe to say that in a year's time there will be work for at least two more European farming experts, one for sugar cane and the other for cotton. It must be remembered that men fresh from the University, who have never had any experience in the Central Provinces, although they might have been brought up in the Bombay Presidency, or in some other district of India, require at least one year to be trained to local conditions before they can do any useful demonstration work.

Four of the seed unions have been registered as Co-operative Seed Unions, and the time is not far distant when, by means of the organisation that is already created and is sure to extend, the Department of Agriculture of the Central Provinces will practically have a monopoly of the seed supply. In the Appendix will be found, for the information of the other cotton-growing Provinces of India, the Rules for the guidance of members of Co-operative Seed Unions, and the By-laws for Agricultural Unions.

Seed

Farms.

I visited several of these seed farms, where, it must be mentioned, a special overseer is kept for the purpose of checking the various plants and making sure that none but the pure strain is being grown. The seed for the

120 seed farms is, as mentioned already, supplied by the two nucleus seed farms of the Government. On the seed farms the second generation of seed is grown. The seed from the seed farms is handed down to branch seed farms, where the supervision is perhaps

not so strict as in the seed farms belonging to the Seed Unions. The effect of these seed farms may be gauged by the fact that round the village at which the seed farm is situated some 2,000 acres were under cotton, and of this area about 1,600 acres were grown with seed from the seed farm. The increased profit to the village is estimated as follows :—

	Rs.
600 acres at Rs. 10	6,000
1,000 acres at Rs. 5	5,000
	<hr/>
	Rs. 11,000

The seed from the seed farms is sold at twice the rate ruling for ordinary bazaar seed.

The leading landowner of the village of Gaigaon, where one of the seed farms which I visited is situated, had a small ginning factory erected.

The cost of the factory was as follows :—

	Rs.
One 6 h.p. Gardner oil engine	1,100
Two gins	600
Cost of shed and paving of yard	600
Belting, shafting &c.	200
	<hr/>
	Rs. 2,500

The price of the land on which the factory is built is very small.

The expenditure for running and upkeep is as follows :—

	Rs
Consumption of oil during 24 hours	6
Labour	2·4
Lubricating oil	·12
Castor oil for gins	1
	<hr/>
Total daily outlay for 24 hours	10
	<hr/>
Depreciation	250
Renewal of rollers	100
Stoppages for holidays and cleaning, and interest	400
Six months working at Rs. 10 per 24 hours	1,800
	<hr/>
Total charges	Rs. 2,550

This gin is able to handle 900 bojas—small bales of 280lbs. each, in six months, for which Rs. 4·8 per boja are paid = Rs. 4,050

Deducting above charges of Rs. 2,550

Net profit Rs. 1,500

The gin works day and night. During the night oil lamps are used, and I fear the factory is not insured against fire.

The excellent profit made on the small factory should enable the owner to reduce his charge for ginning.

The owners of seed farms receive the seed from the nucleus farm of the Government on the understanding that they will grow the seed according to the instructions given by the Department of Agriculture. They undertake, for instance, to manure the fields, to gin the cotton raised, separately, and to use the seed themselves, or sell it to others for sowing, and not for feeding or crushing purposes. The Department constantly has applications for new seed from cultivators, who are willing, not only to pay a higher price for the selected seed, but also to accept the conditions above referred to.

The Akola seed farm produces twice as much cotton per acre as the average farm in the Central Provinces, and this is due to the intensive cultivation carried on at the farm. The Akola farm has during the last few years made a handsome profit, and demonstrates, therefore, not only that crops twice as large as those of the cultivators in the neighbourhood can be grown, but that a profit can be made. The Akola seed farm has 271 acres, all of the black clayey loam, typical of the cotton tract of the Central Provinces. The two staple crops grown on the farm are cotton and jowar. It has been conclusively proved that Rosea, which gives from 39 to 40 per cent. of lint approximately one-sixth more than any other cotton which has been tried in the Central Provinces, is by far the most profitable cotton for the soil and climate of this part of India. When all the cultivators of Berar grow pure Rosea the farming profits from cotton cultivation in this division will be increased yearly by Rs. 20,000,000.

The kinds of cotton grown are :—

Kinds of Cotton.

Variety.	App. Staple.	Average Yield for 4 Years in lbs. per Acre.		
	Inch.	Of Kapas (seed- cotton).	Of Lint.	Of Seed.
G. Malvensis	$\frac{7}{8}$	373	112	261
G. Vera	$\frac{3}{4}$	334	115	228
G. rosea	almost $\frac{5}{8}$	402	161	241
G. rosea cutchica ..	$\frac{1}{2}$	412	150	262
Berar Jari	$\frac{5}{8}$	371	132	239
	(mixture different	of a great	number of	
Buri (G. hirsutum) ..	1	303	100	203
Bani (G. indicum) ..	1	255	74	181

Generally, all the six different kinds of cotton are found growing side by side in one and the same field, *i.e.*, cotton varying from $\frac{1}{2}$ inch to 1 inch, and varying also largely in yield and ginning out-turn. This

mixture is generally known as Berar Jari. The Department of Agriculture has separated the different varieties, and has ascertained the districts in which the various types grow best. It has been proved beyond doubt that Rosea is the most profitable for Berar and the Central Provinces. It is a hardy variety and suffers less than the others from the vicissitudes of the climate and from the cracking of the black cotton soil, which, owing to the heat of the day, takes place soon after rains. Rosea is earlier than the other varieties, and its seed gives a high germinating percentage. Through plant to plant selection the ginning out-turn has been improved, and is now 40·3 per cent. It is this cotton which has also been grown with great success in the United Provinces.

At the Akola seed farm I noticed an experiment with wind screens, which had proved to be successful. These wind screens



A wind screen of millet on the Akola Seed farm.

consist of two rows of Jowar every 20 yards, and leaf blight (a reddish tint of the leaves) is thus prevented.

Buri is now only grown on the rich village lands, and in those districts where cotton is generally affected by wilt. *Buri* is entirely immune from this disease. About 600,000 acres of this cotton are grown, which produce 1,500 bales. These have been bought every year by a Nagpur spinning mill.

Bani is a silky, fine cotton, of 1 inch staple, perhaps the finest cotton grown in India. It was largely exported at one time under the name of "Hinganghats," but the yield per acre is about one-quarter less than that of the local Jari, and the ginning out-turn is only 26 per cent. for *Bani* against 35 per cent. for Jari. Taking the yield per acre and the ginning out-turn into consideration, the advantages for the grower are considerably in favour of Jari cotton, and consequently *Bani* has practically been given up. The ginner fixes his value almost entirely on the ginning out-turn, and conse-

quently the cultivator receives less money per pound of seed cotton of Bani than per pound of seed cotton of Jari.

Bani is grown mixed with Jari in the Nizam's Territory, and in small parts of the borderland of Berar adjoining the former. There is certainly no *pure* Bani grown anywhere except on the Government experimental farms.

Rosea cutchica is slightly inferior in the quality of its staple to *rosea* and gives from 2 to 3 per cent. less lint.

Malvensis and *vera* give about the same out-turn of lint, which is nearly equal in quality to Bani. There is great variation in the quality and percentage of lint of different strains of *Malvensis*, and



The "bakhar," used also in Madras and south of Bombay.

it is therefore believed for that reason that there is much scope for its further improvement.

Modern agricultural implements are stocked by the farm and sold in fairly good numbers, the various Agricultural Associations acting as agents for the sale.

Methods of Cotton Cultivation.

Owing to the wide fissures, which one can notice all over the country in dry weather, it is a common saying in India that the black cotton soil ploughs itself. The cracking of the soil takes place immediately after the rains, *i.e.*, in November, and therefore quickly maturing kinds of cotton must be grown, as otherwise the roots of the plants get torn asunder owing to the cracking of the soil. For this purpose it is necessary to sow in June so that the bolls set towards the end of October. This accounts for the fact that the cotton soils in the Central Provinces are ploughed very seldom, only once in 10 years, it is said, with the ordinary country plough. The usual method of preparing the soil is to use the blade harrow (locally known as "bakhar"); this implement consists of a knife-like blade attached to a short wooden beam, which is drawn by a bullock, the cultivator pressing the blade

into the soil. Thus it may be said that the surface soil is simply scraped. It is the custom to "bakhar" the fields in this manner two or three times during the hot weather, and then again just after the first rainfall, *i.e.*, immediately before sowing. The sowing is carried on in a very primitive manner. The sowing implement consists simply of three tubes or bamboo sticks fastened by string to a wooden beam and supported by the left hand whilst the seed is dropped into



The Cotton Seed Drill, used in many parts of India.

the tube by the right hand of the sower. The sowing is done on the flat in straight lines, the drills being from 15 inches to 20 inches apart; the plants are generally thinned out to a distance of 6 inches to 7 inches. It will be readily understood that in consequence of this primitive method of sowing a number of vacant spaces occur. Sometimes the seed is held by a small cup attached to the top of the tube, and whenever this wants replenishing vacant spaces occur in the drill. Where the seed in a cotton field has not come up or where seed has not been put in through the fault of the sower, and when it is too late to replant cotton, it is the custom to dibble into the bare places "jowar" seed (millet).

Intercultivation (*i.e.*, loosening the soil between the rows) is carried on by a similar blade-harrow instrument closely resembling the "bakhar" already described. In this case two or three implements are worked by one pair of bullocks. Each field is intercultivated four or five times until the bolls begin to form.

Sowing begins about the third week in June and the picking begins somewhere about the third week in October. Buri, Bani, and other exotic kinds of cotton generally take 14 days longer to mature; the fields are picked over every three weeks, the first picking contains a higher percentage of bolls affected by boll worm. The second and third pickings in the Central Provinces give the best lint and seed;

four or five pickings are generally obtainable, the last taking place in January. It is very strange that in many other Provinces of India the first picking is the best, whilst here the second and third are decidedly superior. As early as February the cultivator begins to prepare his land for the following year's crop.

The wages paid for picking cotton are 5 annas per 40lbs., and a woman can pick on an average 45lbs. per day. Until quite recently it was the general custom for the pickers to receive a certain quantity of the cotton picked, say one-twentieth, in lieu of wages.

On the Government farms the wages for permanent labourers are Rs. 8 per month during eight months of the year and Rs. 9 per month during the four harvest months. In Berar labourers often hire themselves out for the whole year, in which case they receive Rs. 70 to 80 in cash at the beginning of their employment and some small portions of green crops during the year.

No strict rotation of crops is adhered to; in some cases, on the rich lands near the villages, the cultivators will grow cotton year after year without rotating with any other crop.

Manure. Manures are more highly valued in the cotton tract than in any other part of the Province, nevertheless a large portion of the cattle dung, which is really the only manure used on a large scale, is made up in cakes and burnt as fuel. Unfortunately, fuel is scarcer in the cotton tract than in other districts owing to the absence of forests. Manure as a rule is not used for cold weather crops (*rabi crops*) except in the case of irrigable garden lands. The Agricultural Department has been experimenting with "poudrette" (dry night soil), cattle urine, conserved by the dry earth system, and various nitrogenous fertilisers. The results of these experiments are given in the annual reports and are most instructive. Of all the manures tried "poudrette" has proved the most valuable; it is obtained only in the vicinity of large towns, where the municipality collects it in pits. There is, however, a great aversion to the use of this manure on the part of the natives, and none but the very lowest caste can be persuaded to use it. The nitrogenous fertilisers invariably give a considerable increase in the out-turn when applied to cotton grown on black soil, but the value of the increase is not commensurate with the cost of the manure. An application of cattle dung followed by a top dressing of nitrogenous fertilisers, such as nitrate of soda and saltpetre, has given distinctly promising results. The Agricultural Department is of the opinion that the cotton cultivator can best be assisted by showing him how to make a proper use of the locally obtainable manures, such as dung and urine of his cattle, and the dry earth system of conserving the latter is strongly recommended.

Causes of Mixing.

Besides the intentional mixing carried on in the ginning factories, there are a few causes which may not have been sufficiently considered. Cattle are largely fed on cotton seed; as much as 4-5lbs. per day are given, and some of the seed passes without being digested. Therefore it frequently happens that the dung contains whole seeds, and these, after being put on the fields with the dung, spring up and cause a mixture.

It is also frequently the custom to send cattle into the fields after the last picking for the purpose of eating the cotton leaves. Another cause of mixture is the late picking, *i.e.*, picking when the cotton is over-ripe, because the bolls begin to shed and some of the seed sows itself, and when another kind is sown in the next year two varieties are at once present.

Insect Pests. The boll worm does not do as much damage in the Central Provinces as in the Punjab and other parts of India. It has been found that exotic cotton tried in isolated plots in non-cotton tracts are often severely damaged by boll worm and leaf caterpillars, but when these kinds are grown on larger areas the damage is much less severe. Bhindi (*Hibiscus esculantus*, or lady's finger) has been tried with success as a trap crop on the experimental farms, but it is doubtful whether it can be used with advantage by the cultivators in villages where there is little or no demand for "bhindi" as a vegetable. "Bhindi," or lady's finger, is preferred by the insects infesting the cotton plant, and as it comes into leaf before cotton, the insects collect in it; at that period the "bhindi" must be taken from the field and destroyed.



On an average 5,000 cotton carts enter Akola every morning. Many beggars sit outside along the road side and beg from the ryots a handful of cotton.

Unless this vegetable is destroyed as soon as the insects appear, it will act as a breeding area for them. Bhindi seed is mixed with the cotton seed in the proportion of 1lb. bhindi to 100lbs. cotton seed.

Experiments are also being made with the parasite "*Rogus Lefroyi*," which destroys the boll worm by making its living place in the worm. In some Provinces these parasites have been to a certain extent successfully reared, but in others new parasites have attacked the boll worm parasite.

Cotton Markets.

It is customary for the farmers to bring their unginned cotton for sale to a cotton market. I visited the Akola Cotton Market; it was established some 10 or 12 years ago. It is open from 7 to 11 in the morning, and from the early hours the cultivators bring the seed cotton, mostly loose, in primitive carts to this market. For each cart a levy of 1d. is charged by the Municipal Committee. Five members of the Town Council are appointed to act as a committee on the cotton market. Each cultivator has his own agent, who shows the samples to buyers. When a price has been agreed upon the cotton is delivered and weighed on a beam balance. The agent (*adhatia*) generally pays cash in the evening to the cultivator, whilst he himself receives the money from the buyer on the following day. The commission to the "*adhatia*" is 1 rupee per cart. The price of the cotton is fixed almost solely on the ginning out-turn and the colour; the length of staple is generally left out of consideration. In the busy season as many as 5,200 carts of cotton change hands in one day in the Akola Market.



Harvesting Berseem in Central Provinces.

I think the market authorities at Akola, and at other markets, should discuss the question of having all cotton that enters the markets graded, just as is done in Tokar in the Anglo-Egyptian Sudan. There, a Government grader inspects all the cotton, grades it, and marks it with the grade, after which it is sold by public auction. This method has been found to stimulate the growing of pure cotton, and clean picking.

Sindewahi, Chanda.

The Department of Agriculture started, last season, a new farm at Sindewahi, about 100 miles south of Nagpur. The Government has bought 150 acres there. The farm was chiefly obtained for the purpose of undertaking sugar-cane experiments, and, undoubtedly, the sugar canes looked

very promising. All the crops of the farm were grown with the help of irrigation, the water being obtained from one of the large tanks, but, as sugar cane requires a great deal of water, roughly about five times as much as cotton, only 20 acres of the 150 will be grown with cane.

Cambodia cotton, which is a new variety to the Central Provinces, was grown there during last season with excellent results. I took a large sample of this Cambodia cotton to a meeting of millowners at Cawnpore, and they expressed great satisfaction with the quality. The spinner who examined the sample most closely reported to me as follows :—

Cambodia from Chanda. “ This is no doubt a very fine cotton, and is one of the best, if not *the* best cotton, we have seen grown in India. As compared with American, it is equally as fine as regards diameter, and the length of staple is $1\frac{1}{8}$ inches. It has, further, the good quality of not containing much short fibre. From a spinner’s point of view, it is about 10 per cent. better than the American cotton we import.”

The Department of Agriculture has already received orders for seed for 400 acres of cotton, which the cultivators round the farm wish to sow ; and the Director is distributing leaflets describing in the vernacular the method of cultivation, as for about 30 years cotton has not been cultivated in these parts.

Buri cotton has also proved satisfactory under irrigation. The following report on this cotton was given to me by a spinner :—

Buri from Chanda. “ This is a cotton which we think it would pay to look after, as we think it might be still further improved. This is a most suitable cotton for counts from 24’s warp to 36’s weft. The mean length of staple is nearly $\frac{7}{8}$ of an inch, being equal to a good deal of the American cotton which we import, but it is scarcely as fine in diameter. It also contains more short fibre than Cambodia, which is a fault that should be avoided.”

During 1914 some 50 acres on this farm will be devoted to cotton. The Cambodia crop gave in certain plots as much as 1,500lbs. of seed-cotton per acre, and the ginning out-turn promised to be very satisfactory. Cambodia will do well on the red soil tracts, which spread over the whole of Chanda in big patches ; and as cotton in this district is very little grown so far, one can foresee an important extension of the crop, judging from the exceptionally good results obtained at the farm. In view of the excellent organisation of the Department, we may look forward to a considerable development of Cambodia. There is a large number of tanks in this province. Asola Menda, for instance, has a huge tank, which is not sufficiently made use of, and it might be worth considering whether it would not pay a combination of spinners to obtain a reservation of land, say 10,000 acres, for a large plantation. The great drawback is that, so far labour has been scarce. The provincial Government is evidently anxious to assist in such a development.

**Sugar
Syndicate.**

At Jalodi, Balapur, not far from this Government farm at Sindiwahi, the Central Provinces Sugar Syndicate, Ltd., has started a sugar-cane plantation. The syndicate has received a concession of 3,000 acres, 1,000 of which will be given sufficient water from a reservoir for the growing of cane. The terms under which the land has been obtained are : First three years, no taxation ; fourth year, 1 anna per acre, and every succeeding year an additional 1 anna per acre. The Syndicate intends to grow sugar cane on 1,000 acres every year, and cotton on the remaining 2,000. At present the land is well wooded, and big game, such as bears, boars, and leopards, are plentiful, and tigers have also been seen. So far only about 40 acres have been cleared by hand labour, the cost of



Clearing the land by hand labour.

which is calculated to be Rs. 34 per acre. It is however intended to introduce Fowler's steam tackle. The quality of the soil is very good, a somewhat reddish loam with streaks of black soil intervening. The surface is fairly level, though somewhat undulating.

Cotton used to be grown in this division, but hardly any is now cultivated ; the principal crop is rice, which is grown year after year, on the same ground. Wages, owing to the scarcity of labour, are high ; at ordinary times 4 annas per day, whilst at the time of the rice harvest 8 annas are paid.

According to the tenancy law of the Central Provinces, a tenant obtains the right of occupancy if he has cultivated a piece of land for more than one year. For this reason it will be a difficult matter to run a plantation on the half-share system, and, as regards cotton, it has certainly been proved, over and over again, that plantations worked solely by daily wage labourers are not so remunerative as those worked on the share system. The Central Provinces Sugar Syndicate, Ltd., would like to see cotton spinners interested in their concern, as they will cultivate, ultimately, two-thirds of their property with cotton.

The annual rainfall of the district is 50 inches.

The nearest ginnery is 50 miles away.

Wardha Solage farm. I paid a visit to the Solage farm at Wardha. The town refuse is conveyed in open drains, neatly tiled, to a plain in a hollow, about one mile from the town. The corporation has bought there about 5 acres of land, and sublets it, in small lots, on the half-share system to tenants. Water and refuse are supplied free once a week to each field. There is a surplus of solage to feed the whole of the irrigable plain of about 25 acres. This year the first experiments have been made with solage, and excellent crops have been obtained, especially maize, chillies, and cauliflower. The Department of Agriculture is superintending the work of the tenants. I was specially pleased with a field of berseem that had followed maize sown in early June. No doubt other small towns in India could make use of their refuse in a similar way.

Wardha Seed farm. In the neighbourhood of Wardha I visited a seed farm, and on the extensive Rosea field I could only detect two plants of different types. The cultivator who owned this land was undertaking extensive manuring experiments, and had tablets on each plot, describing plainly the quantity and character of the manure used. This work, undertaken entirely by an Indian cultivator on his own initiative, speaks well for the reputation and the work of the Agricultural Department of the Central Provinces. The best results obtained on this farm were those in which half the quantity of cow dung ordinarily used was mixed with nitrate (56lbs. to the acre). The net profit on an unmanured field is Rs. 1 to Rs. 2 per acre, whilst the cultivator maintained that with cow dung and nitrate he would have a profit of Rs. 20. I may mention that the Chilean Nitrate Co. has, during last season, commenced the sale of their nitrates in India, and although the ordinary cultivator will not be able to afford artificial manures, and does not understand the value of them, still I believe that, in the Central Provinces especially, as well as in other parts of India, nitrate might be sold to the cultivator through the medium of the Co-operative Credit Societies or Agricultural Associations. Although Wardha is not far distant from Amraoti, there was apparently no watering being carried on at the presses.

The cost of ginning at Wardha is Rs. 4-8-0 per boja (loose bale = 340lbs.). The ginners pay Rs. 1-8-0 of this into a pool, and Rs. 3 are kept by each firm for running expenses. There are now six pressing factories at Wardha, which, owing to competition, have reduced their charge for baling to Rs. 2 per bale. In the ginneries I saw stacks of cotton covered with sheeting and corrugated iron, in order to protect the cotton in case of rain. Rains do occur occasionally during the ginning season in the Central Provinces.

Note on Cotton Cultivation in the Northern Circle, by the Deputy Director of Agriculture.

Northern Circle. Cotton is only of importance in this circle (which comprises the 10 districts of the Nerbudda and Jubbulpore divisions) in :—

(1) Nimar District.

(2) The western parts of Hoshangabad District, adjoining Nimar.

(3) Sausar Tahsil of Chhindwara District, which adjoins the Nagpur country.

Kinds of Cotton.

In these tracts a mixture of rough short stapled Neglectum cottons is grown. In the two tracts first mentioned yellow-flowered cottons largely predominate, and are more prevalent in the Sausar tract. Cotton seed farms have been started in the Nimar and Hoshangabad districts, and eighteen are working this year. Definite trials at Khandwa in Nimar have indicated that the white-flowered jari, known as *Rosea*, is the most profitable variety to grow. Under the local system of markets cotton is priced largely on the colour, cleanliness, and ginning percentage. *Rosea* fulfils all these qualifications. It possesses a very white lint, which is clean and free from leaf, &c., and has a high ginning outturn bordering on 40 per cent.

These seed farms are privately owned, but are closely supervised by the officers of the Agricultural Department, who eliminate all plants which do not "come up true," and arrange for the separate ginning and distribution of the seed.

Hinganghat (Bani) was tried a few years ago, but an attempt to introduce it on a fairly large scale failed. The lint is of excellent quality, long, silky, and strong, but difficult to pick clean. It is not particularly white, has a low ginning percentage (23·24 per cent.) and its yield is also much less than *Rosea*.

Buri, an acclimatised American cotton, was tried on the deep black soils of Burhanpur. In 1900 the area sown was about 300 acres. The crop averaged about one maund per acre less than Deshi cotton. The lint yield was excellent, and was valued in Bombay and Liverpool as equal to good Uplands. It was, however, impossible to get a fair price for it locally. The local mills promised to give a reasonable price, but failed to carry out their promise and gave little more than for Deshi.

If a local agency for buying the cotton and giving a fair price for it on account of its superior quality had been opened, there would have been a reasonable hope that this variety might have become established. As it was the cultivator found that the heavier yielding Deshi cotton paid him better.

Other areas where cotton is grown on a small scale are the Rehli Tahsil, of Saugor, and at Chappara in the Seoni district. These places are situated on the Vindhyan and Satpura plateau respectively, and I think the areas under cotton in these places might easily be extended. The same remark applies to Betul and other plateau tracts where the soil is well drained.

An early-ripening variety has to be grown, as cold nights in November retard the growth of the plant and prevent the bolls from ripening. For this reason Berar and Nimar cotton seed will not do in these upland tracts. Selection has been carried out for three years past, however, and one or two most promising types have been picked out. A seed farm of some 50 acres of one of these types has been

started at Bakhari in the Chappra tract, and a demonstration farm will be opened at Rehli next June.

Two demonstration farms to show better methods of cotton cultivation are also at work now in the Patan Tahsil of Jubbulpore district.

Ginneries. The ginneries in Akola are mostly in the hands of native firms. The cost of ginning at any of the ordinary ginneries is Rs. 3-4 per 345lbs. lint ; pressing costs Rs. 2-8-0 per bale. I inspected five ginning factories in the Central Provinces ; all were in a state of disorder, the loose bales in the yard were often open at one end, and no care was taken to prevent the cotton becoming dirtied by the dust. I was specially struck with the great amount of loose cotton lying about in the yards of the ginneries. Everywhere is waste of labour ; the cotton is carried from a huge stack to the gin by coolies, and when ginned it is swept out of the gin on to a platform.



Typical view of ginning factories.

There sacks are hung up and filled with cotton by men who press it down with their feet. Instead of automatic transporters for cotton seed which one sees at many gins in India, women carry the seed in buckets to the yard, a distance of about 100 yards from the factory.

Watering of Cotton for the purpose of fraudulently increasing its weight.

In a preceding chapter I have dealt with the question of damping cotton, and I will here confine myself to the description of what I have actually witnessed in the Central Provinces and Berar.

At Akola, I visited all the ginning factories where baling is done. At some of them I was taken for a factory inspector, and in two instances I was told that two years ago a circular stating that the practice of watering was a fraud and must be discontinued, had been sent round by the Government. The owners of these ginning and pressing factories told me that since then they had discontinued watering the cotton. I must say I could not find any trace of it being done. At two other factories, I noticed that the ground from which the loose bales had been removed was muddy, and on further inspection I found the hydrant and hose pipe inside stacks of loose bales, as illustrated

on a previous page. Water was flowing between the stacks, from the damping that had been performed the previous evening. The owner demonstrated to me the process of watering, after first declining to do so. He maintained that it was only done in the evening, and that he could not show me the actual watering as he would have to stop his engine. According to the information I was able to obtain, he would water 100 bales for a full hour, previous to pressing. Sometimes, if a customer desired it, he would give the bales two soakings, early in the morning and late at night. In both cases I was assured that the watering is only done by the special request of the customer, and that practically all the Marwari buyers (chief commercial caste of India) insisted upon this watering being done. The Japanese and European firms will not have the cotton watered. In the case of the cotton I saw, the water had penetrated about one foot into the bales, and the cotton was so saturated with it that one could wring it out as from a wet sponge. The fact that these presses turn out some bales that have been watered and others that have not been watered, proves that there is no technical impediment to pressing dry bales. I was assured by an engineer at Akola; that all the presses could produce bales without the addition of water although, he added, that, with water, the pressing is done more easily.

In one of the factories I was an actual witness of "false packing." The bale which was being packed was made up from three loose bales—two dry bales and one wet bale. Cotton from the dry bales was placed in the box first, then cotton from the wet bale, and at the top again cotton from the dry bales.

At Amraoti, in the Central Provinces, the damping of ginned cotton is carried on very extensively, so much so that the fact is recognised practically all over India. In the chapter dealing with watering of ginned cotton I have given an extract from my diary, describing my experiences at Amraoti.

The European manager of one of the ginning factories at Amraoti told me that, owing to the scarcity of water during this year, and to the absence of Indian buyers in consequence of the financial crisis in India, there is not much watering being done. Very little is to be gained by watering, as the Oomrah cotton becomes very yellow after watering, and the bits of leaf turn black; the latter is a sure indication that the cotton has been watered.

MADRAS PRESIDENCY.

Geographical. The Presidency of Madras is bounded on the north by Orissa, the Central Provinces, and the Nizam's Territory; on the west, by the Bombay Presidency and the Native States of Travancore, Cochin, and Mysore, and on the south and east by the Indian Ocean. Three physical divisions suggest themselves—the long tract of land on the east coast, the narrow tract, considerably shorter, on the west coast, and thirdly, the high tableland between these two. These divisions are formed by two great mountain ranges, the Eastern and Western Ghats, the latter being close to the Indian Ocean and of a considerably greater altitude than the former. The Western Ghats are of great importance to agriculture in the west, as they hold up the lower rain clouds that sweep from the ocean during the period of the south-west monsoon, and cause plentiful rains to fall; this territory is known as the Malabar coast, and stretches about 30 to 40 miles inland. Rice, pepper, and spices are the crops usually grown. The upper portions of the hills are well timbered. Cape Comorin is the most southerly point of India, and from there, almost up to the river Kistna, the Carnatic region extends. To the west of this tract, the Ceded Districts which Great Britain received in 1800 from the Nizam of Hyderabad, are situated. The region from the Kistna river to the boundary of Orissa is called the Circars.

Population and Area. Excluding Travancore and Cochin, the Madras Presidency has a population of close upon 42 millions, with a mean density of 291 to the square mile; the area covered by the census of 1911 was 142,330 square miles.

Irrigation. The most important major works of irrigation are situated in the deltas of the Godavari, Kistna, and Cauvery. These works supply water to 2,750,000 acres. A scheme is under consideration for constructing a reservoir in the Kistna district. This will necessitate the construction of a dam the cost of which it is estimated will be over £5,000,000.

Apart from the Government irrigation works, the number of privately-owned wells in the south of Madras is, I am glad to say, largely on the increase.

Cotton Tracts. Cotton is the chief industrial crop, and its expansion during the last decade has been very marked, the exports having doubled in quantity. Owing to high prices and improved qualities, the value of these exports is now more than three times as much as it was at the beginning of this century. The cotton-growing tracts of the Madras Presidency are the Ceded Districts (Bellary, Anantapur, and Cuddapah) and Kurnool, a portion of the Kistna, and Coimbatore, Madura and Tinnevely. The whole area planted last season with cotton was $2\frac{1}{2}$ to $2\frac{3}{4}$ million acres. The varieties of cotton grown in Madras are: (1) Cocanadas, (2) Northern, (3) Western, (4) Uppam (also called Ukkam), (5) Nadam (also called Ladam), (6) Karunganny, (7) Bourbon, (8) Cambodia.

The first three are cultivated in the north, whilst the others are grown in the south, although Cambodia is being tried also in the northern district.

**Department
of
Agriculture.**

At the head of the department is Mr. D. T. Chadwick, I.C.S., as director; the agricultural experts occupying the posts of deputy-directors are: Mr. H. C. Sampson, of the Southern Division, and Mr. G. R. Hilson, of the Northern Division.

A third deputy-director joined the Department in January, 1914, on probation; there are also two assistant-directors (Indians, who have been in America and England for three years). Until January, 1914, the agriculture of the Presidency had been superintended by two deputy-directors, each in charge of, approximately, 20,000,000 acres. The director has also under his care the Agricultural College at Coimbatore, to which are attached a chemist, mycologist, entomologist, and a recently-appointed economic botanist. With the exception of the botanist the time of these gentlemen is almost entirely devoted to the teaching of students.

I consider that the work of a deputy-director should consist mainly in going through the districts under his charge, and explaining to the cultivators the advantages to be gained by the use of selected seed, by improved methods of cultivation, and by the establishment of Co-operative Credit Societies. He should also point out to them the errors made in cultivation. At present, in addition to their other work, the deputy-directors have to direct and supervise the work of the managers of Government farms, who are all graduates of an Indian Agricultural College; another of their duties is to give daily attention to a voluminous correspondence. Under present conditions it may be said that these men are to a large extent directing the agriculture of the Presidency from railway trains. It will be readily seen that it is utterly impossible for any man, even in a lifetime, to become personally acquainted with the conditions existing in a tract of country of 20,000,000 acres. It must be remembered that in addition to the continual riding in railway trains, there are visits to be made from village to village, either on horseback, or in a bullock-cart, addresses to be given to the people at each stopping place, and visits to the fields to be made. All this in an enervating climate. The fact is that during the hot season the work is only possible early in the morning, and late in the afternoon. The Government farms require constant superintendence on the part of the deputy-directors, and these gentlemen are often as far as 300 miles away from headquarters. The journeys are frequently made on lines over which one train per day is run, at the rate of 20/25 miles an hour, with frequent waits and changes at junctions. Even those who have not undertaken similar journeys will realise with what great difficulties the work of the deputy-directors of agriculture is conducted. After travelling 10 to 14 hours in a train during the hot weather, not much energy is left for work. At present, through lack of a sufficient staff, the agricultural expert is obliged to spend a great deal of his time on the Government farms, and only comes occasionally in contact with the ryot, whom he ought to know personally. The expert has not only to

forego the advantage which would follow a better acquaintance with the cultivators, as well as with villages under his charge, but he is unable by force of circumstances, to acquire a thorough knowledge of the languages spoken. The Indian civil servant whose duties as deputy-commissioner, settlement officer, administrator of famine relief, &c., have compelled him to enter into the life of the village, possesses, as a rule, a better knowledge of the local language than the deputy-director of agriculture. It is one of the duties of a collector, or commissioner, to make a tour through his district during some part of the year, and the deputy-director of agriculture should have the opportunity of doing the same. At present the latter sends one of his farm managers to a few villages in the neighbourhood of the farms, but the Indian cultivator does not take nearly so much notice of advice given to him by a fellow countryman, as of advice given by a white man. I think it must be rather uncomfortable for the European agricultural expert to be obliged to address the cultivators through the medium of farm managers. Perhaps the language difficulty in Madras offers special obstacles, as the Tamil and Telugu languages are exceptionally difficult to learn, yet this is all the more reason why the European experts should have fuller opportunity of acquiring them. In no other province of India is an increased staff of agricultural experts more urgently needed than in Madras, on account of the enormous area that has to be covered, the slow train service, especially in the north, and the language difficulty. As regards the language difficulty, agricultural experts recruited from Indians of other provinces would not be at any advantage, as the Madras languages are entirely different from those spoken in other parts of India.

The Director of Agriculture, fully recognising the unsatisfactory position of the work of his department, has applied for three additional European agricultural experts; and His Excellency the Governor, Lord Pentland, P.C., G.C.I.E., with whom I had an interview on the termination of my visit through the Presidency, expressed his agreement with the urgency of the need for the appointment of additional experts.

A further justification of this demand is found in the following comparative statement of the land revenues, areas cultivated, and expenditure of the agricultural departments of Bombay, Central Provinces, and Madras:—

	Land revenue in lakhs of rupees.	Area Cultivated (millions of acres).	Expenditure on agricultural departments (excluding that on college buildings) in lakhs of rupees.		
			1909-10	1910-11	1911-12
Bombay	494	28 $\frac{3}{4}$	5.3	5.8	6.33
Central Provinces	185	24 $\frac{2}{3}$	2	2.2	2.8
Madras	670	39 $\frac{1}{8}$	2.7	3.2	3.4

Further reference to the urgent need for an increase in the staff of agricultural experts will be found in the paragraphs dealing with the different cotton districts.

Government Farms. The Department has farms at : Koilpatti in the Tinnevely district ; Palur in the South Arcot district ; Samalkota in the Godaveri district ; Anakapalli in the Waltair district ; Hagari in the Bellary district ; Nandyal in the Kurnool district ; Sirvel in the Kurnool district ; Taliparamba in the Malabar district.

Samalkota is 426 miles from the head-quarters of the Deputy-Director ; and Taliparamba about 475 miles.

NORTHERN DIVISION OF MADRAS.

Cocanadas Cotton. Cocanadas cotton is short, $\frac{5}{8}$ in. in length, rather coarse and reddish in colour ; the yield per acre is 500–600lbs. of seed cotton, and the ginning outturn about 33–35 per cent. There are at least two kinds, a white, and a reddish, to be found in the fields. Both these are mixed in the ginning factories. This cotton derives its name from the port of Cocanada from which it is mainly exported. It grows in the Guntur, Kistna, Godaveri, Vizagapatam, and Ganjain districts, but the bulk is grown in the first-named. The annual rainfall is about 35in., but towards the west it decreases, being only 15–20ins. in the far corner of the north-west, where Western cottons are grown.

The Deputy-Director has not yet found time to make a full survey of the Cocanadas cottons, as during his four years' service he has not yet been able to visit several of the districts in which it is grown.

The soil is mainly a heavy black cotton soil, but red soil is also to be found. There is a good white cotton in the drab-looking Cocanadas mixture, which it should not be difficult to keep apart.

In the principal district, Guntur, cotton is grown both pure and as a mixed crop ; in the other parts it is entirely cultivated as a mixed crop, principally with rain fed paddy, red gram (Pigeon Pea), and tur (*cajanus indicus*). As a pure crop it yields 500/600lbs. of seed cotton per acre ; in this case it is sown in drills. As a mixed crop, the sowing is done broadcast, and only 100lbs. of seed cotton per acre are obtained.

The fields of this tract are in excellent cultivation, and the drills are in perfectly straight lines. One cannot help being struck by the absence of weeds and the neat appearance of the fields.

There is undoubtedly a possibility of growing Cambodia cotton in the irrigated tracts of the Cocanada region, but, so far, the Department has not been able to devote attention to the problem of introducing this cotton. The two Government farms at Samalkota and Anakapalli are mainly sugar and rice farms ; the Anakapalli farm has also some garden cultivation.

Cotton is not the main crop in the Cocanada tract ; chillies, sorghum, bulrush millet (*pennisetum typhoidium*), tobacco, gram, sun hemp (*corotolaria joncea*), *panicum milliaccum*, gingelli, and ground nuts are cultivated in the dry parts ; whilst tobacco, chillies,

sugar, turmeric and a great variety of other crops flourish well in the irrigated parts.

Cocanadas cotton does not command so high a price as Northern and Western cottons, which grow in the adjoining region ; but in view of the higher yield and the greater ginning outturn, Cocanadas should be more remunerative to the farmer. The development of the white fibre which is present in the mixture seems to indicate a possibility of increasing the financial return to the cultivator, but the employment of an expert is essential for the purpose.

The total area under Cocanadas cotton, during the present season, is estimated at 322,900 acres. The seed is sown in August-September, and the crop matures in January-February.

**The
Northern
Tract.**

The northern tract extends from Kurnool, through the plain between the Nallamallais (black hills), and the Yerramallais (red hills), into the Cuddapah district. The principal centres are: Kurnool, Nandyal, Tadpatri, Proddatur.

In the whole tract a mixture of white and red (drab) cotton is found ; there are two distinct types in almost every field, viz. : *G. herbaceum*, mainly white, and *G. indicum*, mainly red. On the black soils *herbaceum* predominates, whilst on the red, *indicum* seems to be more in evidence. Red Northern always sell at less than white Northern. Northern, as well as the cottons from the north of the Madras Presidency, are very strong, the *indicum* variety is glossy, whilst *herbaceum* is a dead white. The length of fibre is $\frac{3}{4}$ in. The yield is about 250lbs. of seed cotton per acre, and the ginning outturn percentage is only about 25 per cent.

The Department has separated the "*herbaceum*" from the "*indicum*," and has distributed pure *herbaceum* seed ; meanwhile selection has been carried on, and a strain, known as No. 2, has been obtained, which is white and somewhat glossy, has a fine fibre and is from $\frac{3}{4}$ in. to 1 in. in length. Whilst the yield of this strain is no better than the ordinary variety, the ginning outturn is 5 per cent. higher. This cotton has been raised on the Nandyal Government farm, and great credit for this is due to the Deputy-Director. I exhibited a sample of this cotton at a meeting of the Bombay millowners, and it was greatly admired. Two firms in the south of the Madras Presidency also expressed their satisfaction with the improvement obtained. I visited one of the seed farms belonging to a cultivator where Northern No. 2 was being grown. The field was well cultivated, and I could not detect any mixing of varieties in the field. The owner said he would grow a larger area next year. During this season, about 530 acres of No. 2 were being grown by cultivators on behalf of the Department of Agriculture, the Department providing the seed free of cost, and paying the yearly assessment (Rs. 1-8-0 per acre). When

Larger Seed the cultivator delivers the seed cotton, he can have
Farm wanted. payment in full, or he can close the bargain at any other time he chooses. The seed cotton is ginned by the Department, the lint being sold and the seed distributed in the following season. The cultivator bears all cultivation, picking, and carting charges. The seed farms of the Department undoubtedly act as

good demonstration farms, but the Department only controls the seed for two years, and has not by any means a sufficient seed supply. This is confirmed by the fact that in the previous season the seed in Department depôts in several villages was sold out in the course of one or two days. The whole Presidency only distributed officially 80,000lbs. of cotton seed last year. The example of the Central Provinces is worthy of being followed in the north and south of Madras. In the Central Provinces seed from selected plants is grown on the large "nucleus" seed farm at Akola, which is yielding a good profit every year. The farm has 271 acres, of which considerably over 200 acres are devoted exclusively to cotton. The different varieties of cotton in the Central Provinces are grown on a large scale and absolutely pure on this nucleus seed farm. Over 200,000lbs. weight of improved seed was distributed to seed farms belonging to cultivators, on much the same terms as mentioned previously in the case of the Madras cultivators. The fact that the Madras Department of Agriculture buys the *seed cotton* back from the cultivators owning seed farms, is an advantage over the method adopted in the Central Provinces, but, on the other hand, the areas grown under the direct management of the Madras Department on their own farms for seed purposes is too small. With a larger area there would accrue the following advantages:—

1. Financial profit, instead of loss, as an agricultural expert who cannot work, at a profit, a farm of, say, 200 acres—half cotton, half rotation crops, — is not likely to retain his position for any length of time.
2. The seed would grow as under field cultivation, and not merely as under garden cultivation.
3. Larger scope for plant selection.
4. Such a farm would teach the farm staff *practical* farming, and would be a real demonstration farm.

With regard to the demonstration farms I hold the opinion, contrary to that of many agricultural experts in India, that the first thing to demonstrate is that more money can be made by following the methods advocated than by adhering to old methods. Unless, therefore, a demonstration farm is self-supporting and carried on in such a way as an ordinary cultivator is able to adopt, it fails to fulfil its primary purpose. This remark refers entirely to seed and demonstration farms and not to research farms.

The method of cultivation in North Madras is as follows:

Method of Cultivation.

The land is ploughed deeply, once every four years; or, if the field is overrun with weeds, the land is crowbarred, *i.e.*, crowbars are inserted in the cracks that always form in the heavy black soil, and huge clods are turned over. In the years in which this is not necessary, the procedure is the following. The soil, which has almost the appearance of black cinders, is loosened by means of a kind of Dutch hoe, drawn by two bullocks; and this implement, which is called locally the "guntaka," (see illustration in chapter dealing with Central Provinces) is drawn repeatedly over the ground. When the soil has become thoroughly soaked during the rainy season, and after a further rainfall

in August or September, which is considered the proper sowing season, the cotton seeds are drilled into the ground by a three-tined drilling machine, called the "Gorru." The "guntaka" then passes again over the field. No thinning out is done, but, as the variety has hardly any branches, this does not seem necessary. During the growing season the field is frequently hoed by an instrument called the "papatan," and when the plants have grown the hoeing is carried out by means of the smaller guntaka, two or three of which are fastened together.



Method of Hoeing.

Very little rain falls after the crop has been sown; indeed, there is generally no rain at all from November to the time of picking, *i.e.*, in February. Should showers come in December the crop is frequently spoiled. Were it not for frequent hoeing, and the consequent ascent of moisture, the plants would dry up.

Picking begins in February/March and extends into April. The first picking is the principal one, wages being paid in kind—usually one-twelfth of the quantity picked. The cotton thus obtained, in lieu of wages, is sold to retail shops in bazaars. In these shops cotton from different localities is often heaped up indiscriminately, until there is sufficient to make a bale. It is then sold to a dealer. Not only is this mixed cotton detrimental to the reputation of the cotton of the district, but the seed when sold for sowing purposes must produce a mixed crop. The fact that everywhere in India picking is paid by piece work accounts to a large extent for the leaves, stalks, and other impurities which are found in the cotton. The picking of Northern cottons must be done quickly, as all the cotton matures at the same time, and this again causes carelessness on the part of the pickers, who are mostly women and children. Another reason for the dirty condition of the cotton is that the pickers begin work only at 9 or 10 a.m., after having partaken of

their essential hot meal. The sun is by that time powerful, making the leaves and stalks brittle.

The people have not much choice of crops, and there is none which pays so well as cotton. They grow sorghum in rotation with cotton, and a little Bengal gram (*cicer arientinum*).

Half the ryots, generally speaking, are in the hands of the dealers, who supply them with seed for the crops. As a rule the cultivator has to pay the dealer one maund of seed cotton for two maunds of seed. The dealer also "obliges" the ryot with money advances for festive seasons, burials, marriages, &c., and against these advances, the crops are sold at a price fixed long before they mature. Thus it comes about that the ryot does not profit in every case of higher market prices.

The average holding may be said to be 10-20 acres, but whilst some farm fewer acres, others farm as many as 200. The land is mainly held on the ryotwari system, the assessment being Rs. 1-4-0, 1-8-0, and 2-0-0 per acre.

The Western Tract. The "Westerns" cotton is grown westward from the Yerramallais, in the districts of Bellary and Anantapur, up to the banks of the Tungabhadra river.

The principal centres are: Adoni, Guntakal, and Bellary. The annual rainfall is about 20in., and this accounts for the smaller yield, which is only 200lbs. of seed cotton per acre where cotton is grown pure, and not, as a rule, as a mixed crop; the ginning outturn is 25 per cent. and less.

The cultivation is exactly as described under the heading of Northern, except that Italian millet (*Setaria Italica*) is grown with cotton when the rains have been early and plentiful.

The total area grown last year under Northern and Westerns was 881,500 acres.

"Westerns" has also red—or, better, khaki flakes mixed with it; but in the fields I saw, the quantity did not appear to be so great as in the case of Northern.

The Government farm at Hagari in the Western tract is "Westerns." specially well managed. A strain of the usual Western cotton, called No. 1, has been selected, which is a decided improvement on the local cotton. Its ginning outturn is 27 per cent., against 25 to 23 per cent. of Northern; its colour is a good white, and the length of fibre is $\frac{7}{8}$ in.; it is slightly glossy, and resembles the Nandyal type, No. 2, although it is weaker, and its ginning outturn less. 750 acres, on seed farms, have been devoted this year to the cultivation by ryots of Hagari No. 1, but cultivators have, so far, had a prejudice against it. It has been found, repeatedly, that unless one can offer the ryot something which will show, at least, 10 to 15 per cent. additional profit, he can only, with difficulty, be persuaded to give it a trial. In the case of Hagari No. 1, sufficient inducement does not seem to be offered for him to make the change.

The usual price paid for Westerns during recent years has been Rs. 2-8-0 per 26lbs., the only factors that influence the price being the colour, and the absence, or presence, of leaf and dirt.

The ginning charge is Rs. 5 per "naga" of 312lbs., and Rs. 5 are charged for baling (400lbs.).

The average holding in the Western tract is 30 acres, and the assessment charge varies from Rs. 1 to Rs. 1-8-0.

In years of good rain "jonna" (sorghum) gives a somewhat better return than cotton; it is often grown mixed with cotton.

There is no possibility of increasing the production of cotton in this district except by the use of improved seed which will give a higher yield, and a better ginning outturn.

The cotton fields of the Western tract give one the impression of poverty. The prospects for the cultivators do not seem bright; the soil looks poor, and the rainfall is precarious; the ryot has no choice but to grow cotton every second year, although the yield is small.

In reviewing the three districts producing Cocanadas, Northernns, and Westerns, it appears to me that the Department of Agriculture should preferably develop, in the first instance, cotton in the Cocanada tract, where the conditions are far more favourable than in the other two districts.

Cambodia in the North. The reports of the prolific yield of *Cambodia* cotton naturally extended to the northern part of Madras, and during the last two years its cultivation has been taken up there, partly as a dry crop—contrary to the advice given by the Department of Agriculture—and partly as an irrigated garden crop. It is expected that this season some 5,000 bales of Cambodia will be picked in the northern tract. Cambodia is the only irrigated cotton in the district. Round Nandyal I visited several Cambodia fields on dry and on wet lands. The Cambodia on the latter was grown on a soil which was somewhat reddish, the staple was fully 1 in., and strong, the colour was quite white and glossy, whilst the Cambodia on dry fields, *i.e.*, non-irrigated, lacked in gloss, and felt harsh. In most of these fields I noticed 10 to 20 per cent. of Northern plants mixed up with Cambodia. Here is, therefore, a clear case for seed distribution by the Government; and, as Cambodia seed is easily distinguishable by its size from the small seed of Northernns, the Department should have no difficulty in checking this mixing at the very outset. If seed were supplied on credit by the Department, it would not be difficult to persuade entire villages to take the Government seed.

At the press belonging to Messrs. Binny & Co., at Nandyal, I was shown a lot of cotton which had been offered as Cambodia, but one could see that it was a mixture of Cambodia and local cotton. The mixture was quite evident, not only from the colour, but also from the seed. As Cambodia sells at a higher price than Northernns the dealer had mixed the two, hoping to pass off the lot as Cambodia. As there are, this year, round Nandyal, some 3,000 bales of Cambodia, buyers requiring this cotton should refuse point blank to accept anything but pure Cambodia.

The water for irrigation round Nandyal is supplied from the Kurnool-Chuddapah Canal. There is a possibility of extending the cultivation of Cambodia cotton when the Velgode project which provides for a new branch from this canal is finished. The Government farm at Sirvel is situated in this area. A further

opening for Cambodia exists on the banks of the Hagari river, where there are some garden lands producing tobacco, chillies, &c., but in that case the cultivation would have to be very remunerative (giving a net profit of say Rs. 100 per acre), otherwise the cultivators would not take it up.

Cambodia is entirely dependent upon a suitable supply of water. Grown as a dry crop, it is a very risky crop, as it frequently happens that either the rains are insufficient, or that they do not come at the right time.

Comparative Cost of Cultivation. In visiting the neighbourhood of Nandyal the Deputy-Director and I stopped a cultivator and discussed the comparative value of his crops with him. We were then in his Cambodia field, which was $\frac{9}{10}$ ths of an acre, and next to it was his paddy (rice) field of $\frac{6}{10}$ ths of an acre

I elicited the following information from him :—

Cambodia Cotton.

18 cart loads of cattle manure—if bought	Rs. 36	0	0
Deep ploughing—6 pairs of cattle and 6 men at Rs. 1-8-0	9	0	0
Sowing, $6\frac{1}{2}$ lbs. seed	0	8	0
Weeding, 6 women	1	0	0
Hoeing by bullock	3	0	0
Picking the cotton	5	0	0
Water tax	1	8	0
Assessment	1	8	0

Total cost, including all labour	Rs. 57	8	0
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Estimated yield (low) 30 maunds at 26lbs. at Rs. 3-0-0 =	Rs. 90	0	0
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Net profit on $\frac{9}{10}$ ths acre, Rs. 32-8-0, or per acre Rs. 35-8-0

Paddy (Rice).

2 cart loads leaf manure	Rs. 9	0	0
6 cart loads cattle manure	12	0	0
1 cart load cattle manure, as top dressing	2	0	0
8 women weeding 1 day	1	4	0
Labour of manuring, sowing	2	8	0
Water tax at Rs. 4-0-0 per acre	2	8	0
Harvesting	5	0	0
Assessment	1	8	0

Rs. 35	12	0
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Estimated yield—Grain	Rs. 35	0	0
Straw	12	0	0

Rs. 47	0	0
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Net profit, Rs. 11-4-0 on $\frac{6}{10}$ ths of an acre, or Rs. 20-0-0 per acre.

I was assured by the Deputy-Director that all the charges were overstated by the ryot, that the paddy was over-charged by Rs. 14,

and the cotton by Rs. 25 per acre. It is generally understood in India that when cultivators are asked questions as to the cost of cultivation, they overestimate them, but underestimate the value of the crop. They do this fearing that enquiries are being made with a view to revising the assessment on the land. Nevertheless, these figures are very interesting, as they afford a comparison of the value of the crops. It is really a matter of great importance to find out which crops pay the cultivator best. This information, in my experience, can seldom be given readily by cultivators, only a few of them being able to use figures, and then they often omit the cost of one process or another. At a village some 14 miles from Nandyal we were met by a large number of cultivators and dealers, who, after discussing the matter among themselves, gave us the following figures as representing the exact cost per acre of cultivation of cotton and jowar:—

Cotton (Ordinary Northerns).

Tillage and hoeing	Rs. 6 0 0
Seed	0 8 0
Picking, $\frac{1}{8}$ th of production as wages	5 0 0
Rent	12 0 0
	<hr/>
	Rs. 23 8 0

Hitherto, inferior land had been used for cotton cultivation, and some fields only yielded 5 maunds of 26lbs. of seed cotton; but the average of the district may safely be taken as 10 maunds. Supposing the yield is 8 maunds, the receipts would be Rs. 2-8-0 per maund, or Rs. 20-0-0 for the total yield. The loss would be Rs. 3-8-0. At 2 maunds more, the profit would be only slight.

Jowar.

Tillage and hoeing	Rs. 6 0 0
4 loads of manure at Rs. 3	12 0 0
Seed	0 2 0
Rent	12 0 0
Harvesting, $\frac{1}{8}$ th of production	4 8 0
	<hr/>
	Rs. 34 10 0

Yield, 800lbs. Grain	Rs. 25 0 0
Straw	3 0 0
	<hr/>
	Rs. 28 0 0
	<hr/>
Loss per acre	Rs. 6 10 0

Undoubtedly the expenditure on manure is put at too high a figure in both cases, and, considering the low wages paid, the tillage is also too high. Nevertheless, the two calculations show that on the same basis cotton is the crop which is most likely to leave a profit.

**Seed should
be sold
on credit.**

These cultivators told us that if they buy the cotton seed from the bazaar, or ginning factory, they use 24lbs. to the acre, but if they buy the seed from the Department of Agriculture, they only require 6 to 8lbs. This is, I think, strong proof of the necessity for the Government undertaking the distribution of seed on credit. At present the Department charges Rs. 1 for 26lbs. The ryots have to return, when the crop is picked, to the dealer, one maund of seed cotton, value Rs. 2-8-0 for every two maunds of seed supplied to them by the dealer, but as they require only 7lbs. of Government seed, against 24lbs. of the dealer's seed, a saving of nearly Rs. 1 per acre would result, and considering that probably one million acres are sown every year in the north alone, the aggregate saving would be considerable. We must also remember that one rupee is quite a substantial sum to a man whose yearly income is so small as that of the ryot.

We pointed out to the farmers the drawbacks arising from the payment in kind in lieu of wages, but the answer was merely, "It is the custom."

**Financial
Position of
Cultivator.**

Asked as to the general prosperity of the cultivators, the men stated that 10 per cent. are well off, but all the others require loans. For small loans the rate of interest is $1\frac{1}{2}$ to 2 per cent. per month, *i.e.*, 18 to 24 per cent. per annum, in extreme cases the rate might be 70 per cent. On loans over Rs. 1,000 the interest would be 12 per cent. per annum. I questioned the men as to the extent to which "Takavi" was taken up, and they informed us that it was hardly ever made use of, the reason being that as the people are in the hands of the moneylenders, or dealers, these object to the farmers, who still owe them money, going to the Government for loans.

I suggested to them the advisability of forming a Co-operative Credit Society which would not only help them with advances in the first place, but would also assist them in the purchase of reliable seed, and in the disposal of their produce. The ryots said they had never heard of such a society, but that they could understand its advantages, and would discuss the matter amongst themselves. It seemed to me that these villagers were fully alive to the advantages to be gained from the formation of a Co-operative Credit Society. Unfortunately this movement is not uniformly developed in the Madras Presidency, although in some districts considerable progress has been made. So far as I could ascertain, only three or four Co-operative Credit Societies in the Presidency have taken up the distribution of seed.

The charges for ginning in Nandyal are:—

Ginning.	Rs. 6 for white cotton	} per 400lbs. lint.
	Rs. 7 for red cotton	
	Rs. 8 for Cambodia cotton	

For pressing the charge varies from Rs. 2 to Rs. 4 per bale.

Prior to ginning it is customary in this district to shake the cotton on a platform over which an iron lattice is stretched. Eight coolies in pairs sit on this platform, and shake and rub the cotton. The quantity of dust and leaves which is shaken out is surprising. In Northern India, this operation is usually performed by a machine opener.

In Madras, almost all the gins are Platt's double-roller gins, capable of dealing with 600lbs. of lint in 12 hours. In ginning Cambodia cotton the rollers are set to run more slowly than when ordinary Indian cotton is being ginned. This accounts for the higher ginning charge.

Whilst in all other parts of India, the dealers sell the seed cotton to the ginner, or exporter, and leave him to take the risk of the ginning outturn of each lot, such a risk is not ordinarily taken by the ginner and buyers in Madras Presidency. They only pay on the weight of lint, *i.e.*, after ginning the seed cotton.

SOUTHERN DIVISION OF MADRAS.

I visited Coimbatore and Tiruppur, near Erode; Somanur, further south; and Virudupatti and Koilpatti in the far south.

Method of Purchase. Prior to leaving England, I was told of the falling off in the quality of Cambodia cotton; this was confirmed by the spinners of Madras. One mill manager told me that whilst, two years ago, he used six parts of Cambodia to four parts of Northerns for a certain mixing, he had now to use three parts of Cambodia and three parts of imported American cotton. It is likely that the falling off in quality is, to some extent, due to over-anxiety on the part of the cultivators to produce increased quantities of Cambodia cotton, as it had proved so remunerative a crop. In some villages it has been grown for several years without rotation, and, contrary to the advice given by the Government, many cultivators are planting Cambodia cotton on dry lands, on which, unless rains come at the proper time, it must result in absolute failure. Under such conditions, Cambodia is a chance crop, but some cultivators cannot be persuaded to leave it alone.

Cambodia cotton has shown phenomenal yields in Madras. In my previous report I stated that, according to Government figures, the yield is from 1,250lbs. to 1,600lbs. of seed cotton per acre, whilst yields of as high as 2,500lbs. have been reported. The ginning percentage varies from 33 per cent. to 35 per cent. of lint, and at this rate one bale of lint (500lbs.), and sometimes more, is produced per acre. This is an enormous crop, higher than the average in any other part of the world. The average yield of the United States is estimated to be 194lbs. of lint per acre, and of Egypt 450lbs. per acre. In India it may be said to be 100lbs. It is easy to understand, therefore, that ryots, who had no previous experience of cotton growing, have eagerly taken to the cultivation of Cambodia, but unfortunately for them this has been done often under unsuitable conditions.

The cultivation of Cambodia cotton is undoubtedly spreading in the Coimbatore district, and the fields I visited showed very little mixing of local cottons. It was explained to me that the absence of other varieties was due to the efforts of a local dealer, who had interested himself in the sale of pure Cambodia cotton. It cannot be said that the Department of Agriculture has done much to promote the cultivation of Cambodia. The reasons for this are to be found entirely in the smallness of the staff. I must confess to a feeling of considerable disappointment, as the growing of Cambodia cotton in Madras is undoubtedly more remunerative than the growing of cotton

in any other part of the world. There has been no plant selection by the Government staff, in fact, at Koilpatti, which is the real cotton farm of the Cambodia tract, only two small plots, each about $\frac{3}{4}$ acre, are planted with Cambodia, and this demonstration area certainly looked poorer than many cultivators' fields which I saw. It is very unfortunate that the Deputy-Director, who has charge of this farm, had been called away on special duty, once acting as Principal of the Coimbatore College, and at another time acting on the Cattle Commission. It may certainly be said that the Department has done nothing for Cambodia cotton except to issue a few printed instructions as to the proper method of growing it, and to supply, by request of some cultivators, about six tons of seed, which it purchased from a ginnery. Cambodia came on excellently five to six years ago, when it was discovered by Mr. A. Steele, of Messrs. A. and F. Harvey. The ginning outturn was 44 per cent., but it is now 32 per cent. to 33 per cent. By plant selection, and by the importation, annually, of a small quantity of fresh seed from Cambodia, this falling off in the ginning percentage might have been remedied.

Large seed farms are necessary. Cambodia cotton is such an important crop for Madras that a seed farm should be entirely devoted to it. I recommended this in my last report on India, but regret that nothing has been done in this way. Mr. Steele is of opinion that 1,000 acres would be necessary for the purpose, but I think 400 acres, if a four years' rotation is adopted, would suffice. For Cambodia cotton, garden land is necessary, but this cannot be obtained in a composite block.

Cambodia is an American Upland cotton, which has been imported from Indo-China; its length of staple is 1 inch, and good cultivators can produce the fibre of a uniform length; it is glossy and somewhat creamy in appearance, the fibre is fine, yet very strong. A falling off in strength has certainly taken place.

The cultivation of Cambodia cotton has enriched many farmers, and it was an agreeable surprise to find that a large part of the savings resulting from its cultivation has been employed in the construction of wells. These wells act as preventives of famine and enable the cultivator to grow Cambodia in the proper way. Cambodia requires only two or three irrigations in addition to the usual 27 to 30 inches rainfall. The cost of construction of a well sufficient to supply water for two acres is about Rs. 400 to 500. Cambodia cotton should be grown only in the rich red soil, whilst Tinnevely cotton, the other kind of cotton grown largely in the South, flourishes on black soil; thus Cambodia does not interfere with the acreage devoted to Tinnevely.

Cambodia seed is covered with many linters, and it is a practice when sowing to roll it in cow dung in order that the seeds may not stick together. Sowing is generally undertaken in October; broadcast sowing is practically the only method, although round Koilpatti and Coimbatore the Department has been able to persuade the cultivators to adopt drill sowing. Ten pounds of seed are sufficient for one acre; the field is weeded two or three times by hand; only two waterings are required during the growing season, and the water is obtained by means of primitive lifting machines. At some wells, as many as

5 buckets are lowered. Picking begins in the middle of February, and is carried on every alternate day. Contrary to the practice in most parts of India, picking in the South is performed very carefully, generally early in the mornings, when the dew is on the plants. This prevents dry leaf and other impurities from being mixed up with the lint. It is customary to spread the cotton along the sides of the field and expose it in the sun, in order to cause the evaporation of the dew adhering to the lint. There are two distinct grades of Cambodia cotton. The first is from the picking taken between



Leather buckets at wells are in some districts being replaced by iron buckets.

February and April, and this is by far the better. The second is that represented by the second flush, *i.e.*, the pickings that are obtained after the summer rains in May. When the first picking is finished and the plants look almost withered, heavy thunder rains fall in Southern India. These rains put new life into the plants, causing fresh blooms to appear; finally, bolls form and mature. Cambodia can be used for good 30's twist, and for mixing with Middling American.

Uppam A herbaceous type. It is grown pure on the black soils of Coimbatore, Madura, and north of the Tinnevely (also Ukkam). tract, but it is grown mixed with other varieties in the Ariyalur, Trichinopoly. district, South Arcot district mixed with Nadam and Karanganny. Its fibre is $\frac{5}{8}$ to $\frac{3}{4}$ inch in length. It is fairly strong, coarse and harsh, spins up to 12's-16's. The ginning out-turn is 25 per cent., and the crop ripens all at once. The quality is little inferior to the Northern Tinnevely cotton, and a great deal of it is exported, as Tinnevely, from Tuticorin.

Nadam (also Ladam). This type is grown in red soil as a perennial cotton in East Coimbatore and South Trichinopoly, as well as in North Madras, from necessity, as rains frequently fail during the time when sowings should be made. Where Nadam is grown mixed with Uppam on black cotton soil it is treated

as an annual. Nadam has the advantage that it is drought-resisting, but it is easily affected by heavy rains, which cause a dropping off of the bolls. The perennial plants produce cotton all the year round, more especially after a period of dry weather following good rains. The picking generally takes place from February to March, but nearly all the year through some cotton is showing, and the cultivators, when they require cash, go into the fields and pick some Nadam. In the first year the yield is very small; the best yield takes place in the



The Nadam Cotton Plant.

third year, and after this it declines. The ginning percentage is about 23; the fibre varies in length from $\frac{3}{8}$ to $\frac{7}{8}$ inch, and is very uneven and coarse. Nadam cotton is of very small commercial value.

Karanganny or Tinnevelly. This is supposed to be the original Tinnevelly cotton, and is said to have been introduced after a severe famine in 1868. Tinnevelly is a mixture of Uppam and Karanganny. The latter type is the best of the indigenous cottons, it is slightly creamy, much finer, stronger, and more glossy than Uppam. The ginning percentage is 25 and the length of fibre $\frac{3}{4}$ inch. This cotton is chiefly grown on the black cotton soil in South Tinnevelly, but also on red soils, in preference to Uppam. The red soil is used only when the price of cotton is high.

The yields of Karanganny and Uppam are practically the same. Uppam ripens all at once, and consequently in seasons of severe drought there is a chance of getting the crop matured. If the rains in April and May are favourable, *i.e.*, 4 inches during these two months, Karanganny may produce a second flush. At present 300,000 acres are producing this cotton, giving an average of 90lbs. of lint per acre.

Some four or five years ago a spinning firm imported Jari seed cotton from the Central Provinces and had it ginned in Madras. The seed seems to have been sold, with the result that a great deal of Jari

cotton is mixed with Karanganny. Complaints were very strong on this account last year, and the new arrivals do not seem to be better.

Bourbon. This cotton was introduced in 1840–1850 by the American planters who were employed by the East India Company. It is one of the few survivals of exotic cottons of that period. It is now grown as a perennial cotton east of Coimbatore on dry red soil, especially on soils containing limestone. This cotton is known in the Erode tract as Sacred Thread cotton, but it is not the cotton from which the Sacred Thread is spun. Bourbon cotton is a small yielder, averaging not more than 40lbs. of lint per acre. Its ginning percentage is only 23, but it is silky, soft, fine, and strong. The length of fibre is 1 to $1\frac{1}{4}$ inches. A great drawback is that the lint of this cotton contains a great many immature fibres. It responds readily to rain, and manages to exist through the long periods of drought. All the perennial cottons are overrun with insects.

Insects. The two-year-old plants which I saw looked like wild rose bushes. The stem of almost all the plants had been bored by a ring weevil—a maggot which bores a circular passage below the bark. In the Nadam and Bourbon cottons the weevil does not cause serious injury, as the stems seem to heal up, the only trace of the insect being a thickening of the stem about 1 inch above the ground. Unfortunately this borer does considerable damage to the Cambodia cotton grown in the neighbourhood of perennial cottons. Cambodia is evidently not strong enough to resist the attacks of this insect, and withers completely. I saw a great number of injured Cambodia plants, and by cutting the stem we could trace the passage of the weevil. It is only in these tracts of perennial cotton that this weevil has attacked Cambodia. I could not obtain definite information about this insect, and an investigation by the entomologist seems desirable.

The most up-to-date ginning factory I saw in India is that belonging to Messrs. A. and F. Harvey, at Virudupatti. It is a very lofty shed; the gins are arranged in three rows, and the seed falls on to the ground floor. Automatic transporters lift the seed up into a chute which delivers it outside into boxes, or into a cart. The suction gas-producing plants seem to be specially suitable for driving ginneries and presses.

An amusing, but characteristic, incident occurred on the last day of my Madras visit, which shows how the cultivators underestimate the crop, when it suits their purpose. A farmer came asking the Deputy-Director for an advance on account of cotton he was growing from Government seed. When he was asked if the crop would be a good one, he stated that it would be one and a half puties per acre, but when he was questioned further as to the return made to the assessment officer, who had recently been in the district, he had to admit that he had given half that quantity only as the probable outturn.

The Madras Department of Agriculture should certainly follow the example set by the Bombay Department as regards the eradication of the "heriali" weed. In my previous report I illustrated a Bajac plough, which works 18 inches into the soil. At present the cultivator can only get rid of the weed by digging with the spade. The Bombay Department of Agriculture has bought another Bajac plough and one set of Fowler steam ploughs, which are being hired out to the cultivators. The demand for these implements has proved to be very great.

On the termination of my visit to Madras I made a verbal report to the Governor of the Presidency, Lord Pentland, P.C., G.C.I.E., who showed great interest, and made the suggestion that the question of raising seed might be undertaken by private firms, who would, no doubt, receive great assistance from the Department of Agriculture. It seems to me, however, that the Government possesses such advantages as regards distribution of seed and the encashment of its value, that a private firm could not hope to undertake the work with the same success as the Government. Nevertheless, I think that in some provinces of India the raising and distribution of the seed takes up a great deal of the time of the small staff of the Agricultural Department, and, as the value of improved seed is being more and more appreciated by the Indian cultivator, firms of world-wide renown, like Suttons, Gartons, and others might profitably assist in the work. This refers specially to the United Provinces and the Punjab, where wheat and cotton are main crops.

Bombay Presidency.

This is the third largest Province of the Indian Empire, occupying 123,059 square miles, with a population of 19,672,642 and an average density of population of 160 to the square mile. 19 per cent. of the people live in towns, of which there are many—Bombay, Ahmedabad, Surat, Poona, and others.

This Presidency produced 29·1 per cent. of the entire cotton crop of India last season, and is the largest cotton supplier in the Indian Provinces. Whilst the acreage and yield of cotton in all the other Provinces increased considerably during last season, there was a slight decrease in both area and yield in this Province.

There are five cotton tracts :—

1. Sind.
2. Surtee Broach Tract, or South Gujarat.
3. Karnatak.
4. Ahmedabad Kaira, or North Gujarat.
5. Deccan.

These represent an area under cotton of almost 6,000,000 acres, including Native States.

I.—SIND.

The Province of Sind is in appearance very much like Egypt. The fertility of its soil is largely due to causes similar to those which have made the Egyptian Delta so productive. In Sind, the River Indus has for many thousands of years been depositing silt, principally by inundation, as well as by frequent changes of its course. The river is constantly altering its course, leaving behind it valuable deposits of silt.

Irrigation. Sind, which is almost a rainless district—the average rainfall being under 5 inches per annum—is entirely dependent for its agriculture upon irrigation. Unfortunately, the Sind Canal System has not been constructed with a view to the extension of the agricultural area. The canals in Sind consist almost entirely of inundation canals from the Indus. The inundation canals have water only during the period of flood, *i.e.*, about $3\frac{1}{2}$ months, from June to October, and this period coincides with that during which rain falls in the Presidency proper. The supply is too uncertain for the cultivation of Egyptian cotton, which, it has been proved, could be cultivated with success if the supply of water was continuous. The question of converting the inundation canals in Sind into perennial canals has been frequently under consideration during the last 50 years, and as a result of investigations by a recent irrigation commission a scheme has been drawn up for the construction of a barrage at Sukkur, with a canal on the left bank (Rohri Canal). The total expenditure is estimated at over £5,000,000.

Rohri Canal. A controversy is at present going on as to the necessity for the construction of the barrage, and Dr. Thomas Summers, the late Chief Engineer of Sind, holds the opinion that for the present, at least, this barrage is not necessary.

If the canal *and* barrage are constructed it is calculated that the return on the capital outlay would only be $4\frac{1}{2}$ per cent., whilst if the barrage is not constructed the return will be, according to Dr. Summers, 7 per cent. The Indian Government has made it a rule not to sanction any canal schemes which do not show a return of from 6 to 8 per cent., which percentage is necessary to enable the canal to be classified as a "productive" work. It must be borne in mind that the value of one year's cotton crop on the Rohri Canal would probably equal the total cost of the canal, and that the revenue from the cotton and other Kharif crops alone would make it a productive work. The latest information I could obtain as to the progress of the scheme was "that it is still under the consideration of the Secretary of State for India."

The Sukkur Canal would supply water for about 2,750,000 acres.

Sind supplies ordinarily 1·2 per cent. of the total crop of India, but has this season an area of about 332,000 acres under cotton, expected to yield 133,000 bales. The Rohri Canal would add an enormous area, and although the population is only 3,500,000, yet experience has proved that a large influx of people takes place as soon as irrigation works are completed.

Agriculture in Sind is at present dependent on the following means of water supply:—

- (1) Rain, falling over an area of 10,000,000 acres, mostly desert land: only a small proportion is cultivated.
- (2) Kharif (hot weather). Rice flow, *i.e.*, plenty of water obtainable from river (Indus) and canals for rice cultivation.
- (3) Kharif Lift. Water must be lifted by instruments, such as the Persian wheels. This land is suitable for cotton.
- (4) Jamrao Canal. This is a perennial canal irrigating land suitable for cotton. This canal feeds 700,000 acres with water.
- (5) Bosi. Land flooded once or twice during hot weather and cropped during cold weather. Cotton could be grown on the land.
- (6) Kucha. Flooded silt land, alluvial soil; no cotton at present.

Fallow Land. The striking feature of Sind agriculture is that the native cultivates only one-third or one-fourth, or even one-fifth, of the land he possesses, in one year. The remainder is allowed to lie fallow; fields are left entirely untouched for years, and on riding through the district one sees much more fallow than cultivated land. Whilst these fields lie idle all kinds of bushes grow. The cotton sticks are left standing for years, and I am convinced they harbour insects. I saw a great number of white ants in these fallow fields. The Government does not allow the land to lie idle longer than five years, and if the fields are then not cultivated the assessment is charged also on the non-cultivated land, and if not paid the land is taken away. In Egypt a decree exists, according to which, by December 31st in each year, all the roots and cotton sticks must be pulled up and taken from the fields, as it has been proved that insects increase if the sticks are left in the field.

**Kinds of
cotton
grown**

The ordinary local cotton (Deshi) is of a low class, being only $\frac{3}{8}$ inch to $\frac{1}{2}$ inch in staple, and yielding 7 maunds of 80lbs. seed cotton per acre under good local conditions. The special feature of Sind cotton is that the colour is pure white, and it is for this reason that it is so much appreciated. Spinners frequently use it for mixing with American cotton in order to improve the colour of the latter. The average price obtained in recent years for the ordinary local cotton has been from Rs. 6 to Rs. 7 per 80lbs.

Egyptian.

For a number of years both "Affi" and "Abassi" Egyptian cottons have been grown. Altogether 6,000 acres have been under cultivation with Egyptian cotton in Sind. The produce was collected by the cultivators and sent in different lots to the Mirpurkhas Government Farm, where it was sold by auction. It is quite evident that there were bound to be considerable variations in the quality, cleanness, and value of the different lots, but nevertheless for the first few years fair prices were obtained. The buyers were millowners from Ahmedabad and Bombay, and the exporters from Karachi and Bombay. Several of the millowners who were in the habit of sending buyers were accustomed to use imported Egyptian cotton, but they soon stopped attending these auction sales. They complained that they could not get a fixed grade, whilst when buying Egyptian cotton in Alexandria or Liverpool they got a grade which was uniform and could be depended upon to spin certain counts. For the purchase of Sind Egyptian cotton they had to send their agents on a long journey to Mirpurkhas at a time of the year when malaria fever was very prevalent, and these agents, not speaking the Sind language, thus suffered a further disadvantage. To buy any quantity, they had to bid for a number of small lots, some of which were dirty and stained, whilst others were good. The gins in Sind are only suitable for short-staple cotton, and as they were well engaged on this kind the buyers had great difficulty in getting their cotton ginned at local ginning factories. Egyptian cotton was new to the exporting firms, and the "Abassi" produced in Sind was certainly not to be compared with the Egyptian product. The "Affi" quality, however, was strong and useful. If it had been cleaned properly, ginned, and baled it would certainly have sold at the rates of "fully good fair Egyptian brown." The "Abassi" and "Affi" shipped was never properly cleaned and was full of dirt and pieces of leaf. Experiments have proved that here, as well as in Egypt, "Affi" is a hardier cotton than "Abassi." The Deputy-Director, Mr. G. S. Henderson, who has had considerable experience of farming in Egypt, is of opinion that, provided the cultivator gets 12 rupees per maund of 80lbs. for seed-Affi, it will be more profitable to him than cultivating Sind cotton. "Affi" produces in Sind about 5 maunds per acre, whilst the yield of Sind cotton might average 7 maunds at 6 rupees.

During the last four years the supply of water in the Jamrao Canal has been very short, and the cultivators, not being able to

obtain sufficient water for the growing of Egyptian cotton, had to be released from the undertaking, which they had given when entering into possession of the land, to grow a certain proportion under Egyptian cotton. Until the Rohri Canal is completed it will be impossible, in view of the shortage of water in the canals, to grow Egyptian cotton on an extensive scale.

American. Fairly large trials have been made with a good class of *American Upland cotton*. It has the advantage of a short growing period, shorter than Sind cotton, and consequently it can be grown along inundation canals. There is a very large tract where it can be cultivated. It is a hardy plant, but it is easily affected by salt in the soil, and suffers considerably from white ants. During the past year some good yields were obtained by farmers, and in many cases it produced as much seed cotton as the neighbouring plots of Sind cotton.



A picker in Sind in a field of American Cotton.

As a result of my previous visits, American seed has been imported in considerable quantities and distributed amongst the cultivators in Lower Sind; and a small syndicate of the Bombay Millowners' Association has been formed, on the suggestion contained in my previous report, for the purpose of establishing, in co-operation with the Government of the Bombay Presidency, a buying agency for American long-staple cotton in Sind, and for ginning, pressing, and supplying baled cotton. The syndicate has erected modern gins at Mirpurkhas (Lower Sind) and at Shikarpur (Upper Sind) for handling this cotton; the land for the ginning factories was given by the Government. The syndicate makes its own arrangements for selling the baled cotton, and the prices paid to the cultivator are the full market value of the cotton fixed on the basis of the grading of samples sent from time to time to Liverpool, less the charges for ginning, pressing, brokerage, freight, insurance, warehousing, &c. After the cotton is ginned and baled it is sent to

Karachi, and is sold on sample at an auction in Bombay, in the open market. The syndicate undertakes to return the seed to the Government. The syndicate advances half the value of the cotton at market price to the cultivator on delivery of the cotton, and pays the balance after the auction.

The American varieties grown are Texas Big Boll, Triumph, Toole, Allen's Long Staple, Griffin, and Black Rattler. The length of fibre varies from about .9 inch to 1.5 inch, but is mostly 1.1 inch to 1.3 inch. The quality seems to have suffered this year owing to exceptionally heavy rains which fell in July/August, which greatly damaged the crop—indeed, in some parts entire fields were washed out. Twenty inches of rain fell in about 10 hours—a phenomenal occurrence, for the total rainfall of Sind is, on an average, only 5 inches *per annum*. Whilst the entire cotton crop of Lower Sind has undoubtedly suffered this year in consequence of this unprecedented storm, the crop in Upper Sind has been an entire failure owing to the lack of water. However, 700 bales of American cotton have this season been grown in Lower Sind, but it had been anticipated that three times that quantity would be available.

The ginning factory of the Bombay Syndicate has 10 gins driven by a 45 h.p. Rushton oil engine, the total cost of the factory being Rs. 25,000. The factory does not possess a press, but arrangements have been made for the pressing to be carried out by Messrs. Ralli Bros., who have an up-to-date factory in the neighbourhood.

In the Appendix will be found a short note on American cotton in Sind by the Deputy-Director of Agriculture in Sind.

During my visit the price for ordinary local cotton was Rs. 8.5 per maund of 80lbs., whilst a European firm made the offer of Rs. 14 per maund, seed cotton, for the American cotton grown. Whether this was a genuine offer, or simply an effort to work against the Bombay Syndicate, I could not ascertain. The cotton was, of course, pledged to be sold to the syndicate.

Dolhapur. At Dolhapur Mr. Henderson has reclaimed 400 acres of salt land on the Egyptian method of land reclamation (see the International Cotton Federation's Report on the Deputation to Egypt, 1912). On this tract cotton and berseem have been grown, and whilst the land was formerly considered barren, it has now become most fertile, and the Government recently sold it at high prices.

The Department of Agriculture has acquired 200 acres for a seed farm in the neighbourhood of Mirpurkhas, as it is recognised that sufficient seed is not being distributed.

Vernacular Schools. In connection with the Government farm at Mirpurkhas, the Deputy-Director of Agriculture has commenced a vernacular school in which an Indian, with an agricultural degree, teaches the sons of farmers. The teacher receives Rs. 80 per month. The students live on the farm and provide their own food. Sleeping quarters are provided without charge, and no fee is paid for the first year. This vernacular school is appreciated by the farmers, and I am inclined to think that the

agricultural education of the people of India should proceed more on the lines adopted at this school than on the lines adopted in the large colleges at Lyallpur, Nagpur, Poona, and Cawnpore.

Egyptian Plough. The Deputy-Director introduced the Egyptian plough and Egyptian scrapers a few years ago. At first these were made in the workshops on the farm, but now, as the demand has increased, the village carpenter and a firm in Hyderabad are making them.

In a previous paragraph I have drawn attention to the peculiar official way of keeping accounts, and it is no surprise therefore to find that whilst the cost of making implements, which are sold to cultivators, is debited to the Department of Agriculture, the money received for them is credited to revenue.

Seed Distribution. Co-operative societies are practically unknown in Sind. Seed is distributed from the farms at Mirpurkhas, Sukkur, Larkana, and Landhi, by special agents; and the Revenue Officers also have taken an interest in the distribution of seed.

Land Tenure. In ordinary circumstances the owner of the land does not cultivate it himself, and seldom does he take any interest in it. Each year "haries" or tenants are engaged by the owner. He gives them an advance, or often about 50 rupees for one family, who will cultivate 10 acres. This advance is returned, in kind, at harvest. On flow land the rent returnable to "Zemindars" is often one-half the produce; the latter pay the Government assessment or land tax, which varies from Rs. 2 to Rs. 4 per acre. This is the "butai" system. On lift land the "butai" may be one-third to the "Zemindar" and two-thirds to the "Hari."

Landowners let out the land in lots of about 20 acres, and share the crop with the tenants, consequently they may dictate what crops must be grown. This is a very important factor. As the Deputy-Director is held in high esteem by the landowners, they are generally willing to follow his recommendations. In the North of Sind the tenants occupy the land for several years, but in the South of Sind they are of a nomadic type, and often change every year.

Before much improvement can be effected in Sind agriculture, it is necessary to persuade the average "Zemindar" to take more interest in his land, and not to leave everything to the annual "Hari" or tenant. Then the next important improvement is the introduction of pulse crops, as they not only give valuable seed, but supply fodder for the cattle and improve the fertility of the land.

Ginning Factories. The gins are nearly all Platts' roller gins; they are largely owned by European export houses. The cotton arrives in farmers' bales, on the backs of camels, or on carts, at the gins, where it is ginned and put first into loose bales; after a few days these are hydraulically pressed in the same establishment. It seems to me a waste of time and wages to

put cotton provisionally into bales. The only explanation for the two pressings was that the hydraulic press worked so quickly that the gins could not deliver sufficient cotton to keep it employed all the week, consequently the ginned cotton which they put into loose bales was allowed to accumulate. When a sufficient stock was ready the hydraulic press was started. At none of the ginneries are there pneumatic suction pipes or automatic feeding appliances. The wages paid at the gins are 6d. for men for 14 hours. The average outturn per press is 300 bales of 400lbs. in 10 hours. 100 bales take up 20 tons measurement.

In Sind it is the custom to spread out the cotton in the sun, and to pass it through an opener (cleaner) before ginning. Near Hyderabad, Sind, I visited a well-managed ginning factory, belonging to an Indian. It contained 64 Platts' roller gins, and was worked by a 36 h.p. engine. The whole of the factory was fitted with sprinklers—not automatic, but ready to be worked by hand in case of fire.

I am convinced that there is no watering of ginned cotton being done in Sind.

Method of Cultivation. Sowing after irrigation is done simply by scattering seed broadcast, then ploughing it in and running the wooden log over the land. Sowing the seed in straight lines is said to be impossible in Sind. In the cultivation and preparation of the land the chief things to note are the necessity of thorough and deep ploughing and the getting rid of all weeds, &c. It is an excellent practice to keep fallow land well ploughed. The Punjabi Colonists on the Jamrao Canal know this, and often plough five or six times, during the hot weather, the land which is going to grow wheat; in consequence they have the best wheat crops on the Jamrao.

The Deputy-Director, Mr. G. S. Henderson, introduced Berseem (*Trifolium Alexandrinum*), the Egyptian clover, and this crop is being greatly appreciated by the cultivators both as a fodder crop and as a manure.

In the neighbourhood of Hyderabad I inspected some cotton fields, and was told that the cultivators manured these with town refuse. The soil here is also fine silt; three ploughings are given in May/June, when the cotton is sown, and picking takes place by the end of November.

Bajri and Jowar (Millets) are sown in between the cotton. The first is used for cattle food, and the second for pressing the oil from the seed. Eight to ten waterings are given. The supply for the Hyderabad fields comes from the Fuleli Canal, which was constructed 25 years ago, but evidently the supply of water is not sufficient, as many fields are allowed to lie fallow. The average crop is 7 to 8 maunds of 80lbs. seed cotton per acre, but good fields are said to give as much as 20 maunds. The cultivators in this district use Takavi a great deal. For this they pay 2 annas per rupee as secret commission to the Indian Clerk of the Treasury, and 6·14 per cent. interest per annum. A man cultivating 7 to 8 acres will receive about Rs. 200 of Takavi.

The crops which can be grown in Sind are few in number. Rice is the most important, Jowar and Bajri come next, then wheat and cotton, and small quantities of oil seeds. The other crops only form a very small proportion of the total.

Salt. Salt is found in the soil practically all over Sind, and where it exists in large quantities it is impossible for plants to live. It occurs in small patches, and also in large areas. If present in moderate quantities ordinary crops can be cultivated, but they require much water, and the yield is much lessened by its presence.

Coarse red rice is frequently cultivated. In fact, the continued cultivation of rice for several years will gradually drive the salt into the subsoil. It is considered that rice cultivation is the easiest means of getting rid of salt.

European Cotton Plantation. In the neighbourhood of Mirpurkhas a small European syndicate has obtained from the Government, on reasonable terms, a lease of land for the purpose of growing cotton and Egyptian berseem, chiefly. The area is 1,400 acres, and of these 400 were planted last season under American and indigenous cotton. Unfortunately 60 acres were washed out by the heavy fall of rain of which I have already spoken.

I found that the Deshi cotton looked very well, especially where it had followed berseem. The American cotton seemed somewhat weak in fibre. The plantation is not yet in full working order, and everything was planted in the manner customary amongst the natives of Sind. The manager of the plantation complained that the work had suffered largely from a scarcity of labour. This scarcity was very much felt this year, as, in consequence of the rainfall, which provided good pasture in the desert, a large number of people went there. The field labourers in Lower Sind belong to a nomadic tribe.

The water for this plantation is supplied by flow irrigation from the canal, which cuts through the estate.

The plantation is situated in proximity to the railway, and a small station has recently been made.

At present the plantation is being worked by direct labour, but no doubt when the whole area is brought under cultivation the half-share system will be introduced, whereby the company will receive half of the produce in lieu of rent, and will make a profit on the disposal of the produce. The company will, of course, superintend the work of the tenants.

The area which the company controls is somewhat small to warrant the employment of a first-class European agricultural expert, but there will probably be no difficulty in increasing the holding. Under such conditions it should become quite a lucrative concern.

Upper Sind. Around Shikarpur cotton is comparatively a new crop, but the cultivators seem anxious to give it a fair trial. They complained to me of the insufficient water supply, as the Begauri, Unar, and Shaki Canals are all inundation canals, and during last season water was plentiful only in June. At that

time the cultivators had great hopes, and put the seed into the ground, but no further water could be obtained until July 15th/August 15th, when it was too late. The water supply is very irregular, and I do not think that cotton cultivation will, under these circumstances, make much progress in the north.

The soil is level, and the possibilities of an extension of cotton certainly exist if the Rohri Canal is constructed.

The Zemindars told me that they were pleased, however, with the American cotton, and one large landowner said he would try it on 400 acres next year.

The Bombay Syndicate has built a ginning factory at Shikarpur, but as, owing to the scarcity of water, only a small portion of the cotton has matured, the seed cotton has been sent to Lower Sind, and the machinery at the time of my visit had not been completed.



“Threshing” millet in Sind.

I was unable to visit the remaining portion of the Bombay Presidency, and the following information is compiled from my previous report (1911-12) and from information supplied verbally by the Director of Agriculture.

II.—SURTEE-BROACH DISTRICT.

The principal towns in this district are Surat, Nausari, Broach. The general aspect of the country is that of a level plain relieved by a scattered growth of bābul (*Acacia arabica*), toddy palm (*Phoenix sylvestris*), and other trees.

The soil is deep black and retentive, and under a rainfall of 34 inches to 45 inches, within a period of $3\frac{1}{2}$ months, can support the best indigenous cotton, which requires eight months to mature.

Kinds of cotton. The cotton of this district is that well known as Surtee-Broach. It is noteworthy that the quality of the cotton produced, known commercially as “Broach,” improves as we proceed south, Nausari, near the southern boundary of the tract, producing the finest staple of the growth.

The crop is sown in a two-year rotation with Jowar (Sorghum), with the first rains in the middle of June; picking takes place in February/March. The cultivators are probably the most careful in India.

In parts of certain talukas (village districts) in the north of the tract (viz., Jambusar and A'mod) a coarser variety of the herbaceum species known as "Goghari" is also sown partly on light soil. This is doubtless fraudulently mixed with the finer growth. The growing of an inferior type of cotton in an area suited to and bordering on a finer growth is a matter of considerable importance when the improvement of the staple of the tract as a whole is taken up. The Indian ginner seems to be unable to resist the temptation to mix a low quality with a superior.

The cotton grown generally in this district is Surat "Deshi" Broach of $\frac{5}{8}$ inch staple; the yield on one acre of the Government farm, from plants raised from ordinary Bazaar seed, was 498lbs. of seed cotton, with a ginning outturn of 32.9 per cent.

Method of Cultivation. Instead of a plough, a scraper, as described in the previous pages, is used to loosen the soil prior to the arrival of the monsoon. Ploughing with steel ploughs is only recommended when it is a question of getting rid of the deep-rooted weeds, and then it must be done after the rains, as it would be impossible to plough the heavy black soil in dry weather.

Heriali weed. Many parts of India are suffering from a deep-rooted weed called "heriali" (*Cynodon dactylon*). In the south of the Bombay Presidency I was very pleased to see that a plough had been obtained by the Government with the special view of assisting farmers to get rid of this deep-rooted weed, which soon spreads over the whole field. The plough in question was made by M. Bajac, Liancourt, France, and was worked by means of two windlasses; it is designed on the system of the steam plough. A windlass is fixed on either side of the field, a cable to which the plough is fastened, being wound up by one windlass and let out by the other. The windlass is turned either by two big bullocks or four of medium size. The total cost is Rs. 3,200, delivered in India, and the whole of the machinery appeared well made. The plough moves slowly from one end of the field to the other, but does the work efficiently. One-quarter of an acre is ploughed in eight hours. I measured the depth of a furrow, and found it to be almost 16 inches. The Agricultural Department hires this plough out to farmers at a charge of Rs. 3 per day, and it is a sign of the advancement amongst the cultivators that they have readily taken up this implement. I was told that this plough is booked already for every day during the next three years. Cultivators have been driven to the necessity of digging up their fields owing to the rapid spreading of the weed. The cost of the labour for digging is calculated at Rs. 50 per acre. With a Bajac plough, if they hire the bullocks, the clearing costs them Rs. 28 per acre, the farmer finding the labour. The plough can be easily worked. Two more ploughs on this principle—one worked by steam power—have been acquired recently.

Sowing. After the first break of the monsoon, when about 4-5 inches of rain have fallen, the field is sown on the flat in perfectly straight lines, 2 feet apart. A sowing drill similar to that already described is employed. The plants are thinned out to about 12 inches apart as soon as they are about 6 inches high. The soil is loosened by the inter-cultivator, the scraping implement mentioned previously. It is quite remarkable how straight the lines are sown; the hoeing by means of the inter-cultivator prevents the cracking of the heavy soil and also the evaporation of moisture.

Sowing takes place in July and extends to September if necessary; 10lbs. of seed are required per acre. There is hardly any irrigated cotton in the Bombay Presidency. A great number of draw-wells exist.

Manure. The supply of stable manure is very limited as only one pair of cattle is kept for every 20 or 30 acres. A good cultivator will keep a buffalo for milk and manure, but will never work the cow. During about five months (*i.e.*, principally the dry season) the cow manure is made into cakes and used as fuel. No artificial manure can be used at the present prices. There is hardly any litter used in the stables, and therefore the manure is very rich.

Insect Pests. Generally speaking, the cotton of this district is comparatively free from insects. There certainly are boll worm, asphis, and a surface caterpillar, but none of them is serious except during the cloudy weather at the back-end of the season.

Picking. Women are engaged in the picking; they are able to gather about 40lbs. a day, for which they receive 3d. If the work is carried out by contract as much as 100lbs. can be collected, but dirt, leaves, and other impurities are mixed up with the cotton picked. Scarcity of labour is seriously felt during the picking season, although Gujarat has a population of 419 per square mile, and is one of the most thickly-populated agricultural districts in India.

Mode of Selling Crop. It is customary for dallals (small merchants) to visit the villages for the purpose of collecting the cotton. Cultivators who are in need of money receive advances from them. Any verbal agreement, unless supported by token, is not regarded as binding.

Ginneries. There are more ginning factories in the district than are really wanted, and the various firms have now amalgamated, closed some of the old gins, and the profits of all are pooled and then divided. Only a few of the gins at Surat possess steam presses; in many cases the loose bales of ginned cotton have to be sent by rail to the steam press. I was told that it does not pay to have one of the large steam presses in connection with a ginning factory unless 5,000 bales are turned out per season. The charge for ginning is Rs. 4-8-0 per bhar of 916lbs.; the seed belongs to the cultivator.

Land Tenure.

Generally speaking, the landowners in Gujarat only hold about 20 acres and possess on an average two pairs of bullocks. The yearly assessment per acre for the best cotton soil is about Rs. 7. The system is more or less that of a leasehold with an annual chief-rent of Rs. 7. The farmers may sublet the land, in which case rents as high as Rs. 17 are obtained. Most of the cultivators have borrowed money at a high rate of interest (16 to 20 per cent.), but the loans are not very large. I was told that about 15 per cent. of the farmers who grow the improved Broach cotton require advances from the Bombay Millowners before the crops matured.

Co-operative Credit Societies.

Co-operative Credit Societies have been started. Since 1903 the number in the whole Bombay Province has increased to 350, and they are likely to make steady progress. The Co-operative Credit Societies have no central fund, but a central land bank has been established recently in Bombay for the purpose of financing Co-operative Credit Societies in the sugar cane tract. This central land bank is a private concern, guaranteed by the Government. It lends to Co-operative Societies at 7 per cent. per annum, and the farmer receives the loan from the latter at 9 per cent. per annum.

Wages.

The wages have already risen, and, owing to the scarcity of labour which is making itself felt, there is likely to be a further advance. At present the wages are : Men 4d., women 3d., children 2d. per day of eight hours.

Extension of Cotton Area.

There is no further area in this district which might be put under cotton, but the yield could be materially increased by :—

(1) Clearing the land thoroughly of the deep-rooted weeds, as described previously.

(2) Seed selection ; inferior types must be removed by separating the best strains and selecting from these. A much larger staff is required for seed distribution.

Bombay Millowners' Buying Agency.

In my previous report I stated that, as a result of the recommendations of the International Cotton Federation, the Bombay Millowners had established a Buying Agency for the purpose of guaranteeing to the farmers 5 per cent. for improved Broach above the price ruling for the ordinary local cotton.

This agreement worked satisfactorily during 1912-13, but grave complaints were made by the Bombay Millowners during the season 1913-14. They maintain that the cotton delivered is in no way superior to the ordinary cotton, and supported their case by having tests made. The Department of Agriculture has, on the other hand, repudiated the charge that the quality is in any way inferior to that of last year's crop, and say that the complaint should have been made when the cotton was delivered to the ginning factory. It is unfortunate that this dispute has arisen, as the Bombay Millowners did not establish the Agency as a profit-making concern. They were prompted solely by a desire to assist the culti-

vator. The enterprise was distinctly public-spirited, and it is to be regretted that, so far, no understanding between the Department and the Millowners has been arrived at.

It has been suggested to me that the syndicate may have received the ordinary local cotton by mistake, and that the improved quality may have found its way into the ordinary commercial channels. The fact remains that all the buyers of the cotton complained of the quality, and that a substantial loss has been incurred.

III.—THE KARNATAK TRACT.

The important places in this district are Dharwar, Gadag and Hubli. This tract extends from $14^{\circ} 17'$ to $15^{\circ} 50'$ north latitude, and from $74^{\circ} 48'$ to 76° east longitude.

The district is bounded on the north by Belgaum and Ramdurga State and Badami in Bijapur; on the east by H.H. the Nizam's Territory and the Bellary district of Madras; on the south by the Mysore State, and on the west by North Kanara, and the sub-division of Khanapur in Belgaum.

Rainfall. The following table gives the rainfall during 1912 and the average since observations were taken :—

RAINFALL.

Month.	Dharwar.		Gadag.	
	1912	Average	1912	Average
January	—	0.07	—	0.05
February	—	0.02	—	0.06
March	—	0.34	—	0.20
April	3.54	1.75	1.39	1.60
May	1.79	3.05	1.42	2.46
June	2.76	4.65	2.27	2.84
July	11.82	6.57	4.33	2.53
August	7.68	4.47	3.02	3.51
September	7.06	4.33	11.38	5.81
October	7.68	5.34	6.95	4.37
November	0.64	1.46	0.12	1.14
December	—	0.60	—	0.47
Total	42.97	32.65	30.88	25.04

Temperature. During the last five years the temperature has averaged 97° Fah. in April, and 59° Fah. in December.

The long continuous dry easterly wind in December and January is very injurious to the cotton crop in the flowering stage, but this is minimised in years of good late rains. The crop suffers to a very great extent if the late rains are short. Severe cold and cloudy weather after the bolls are formed is also injurious, as many of the bolls wither. The ante-monsoon rains in March and April in certain years, when the cotton crop is ready for picking, have proved most detrimental.

Nature of Soil. Deep pure black soil, retentive of moisture, has been found to suit Kumpta and Broach cotton; deep medium black soil or shallow pure black soil with gravel, below three feet, suits Dharwar-American and Cambodia cotton. This is contrary to the experience in Madras Presidency, where Cambodia flourishes better in red soil than in black.

Area. The total area of the Karnatak District is 2,948,145 acres; of this 2,351,443 acres are under cultivation and the total area under cotton is represented by 632,539 acres, of which 226,933 acres are under exotic cottons and 405,606 acres are growing indigenous cottons. The average area under cotton for the last 10 years is 573,118 acres. The total area under food crops is 1,376,280 acres.

Possibility of Extension. The present area under cotton might possibly be increased by nearly 20 per cent., as there are large tracts which are suitable for cotton. These tracts lie between the rice area of Mallad and the dry area of the Desh. A beginning is being made in cotton cultivation in these tracts.

The proposed railway line from Belgaum to Hubli, via Saundatti, will pass through the heart of the important cotton tract in the southern division. Similarly, the proposed line from Gadag to Wadi will run through the most suitable area for Dharwar-American cotton. These two lines, if constructed early, will greatly increase the facilities for the cotton trade.

A line between Gadag and Ranabenur would be of great advantage to the cultivation of Dharwar-American cotton, as the great market for this cotton is at present at Gadag, which is far away from Ranabenur, where Dharwar-American cotton is grown to a great extent.

Cotton is grown solely as a dry crop in this division. Irrigation is not employed, either from wells or rivers.

Kinds of Cotton. The following four varieties of cotton are grown by cultivators:—

Kumpta. (1) An old variety called Kumpta (Indian name, Javarihatti), with a staple of $\frac{3}{4}$ inch, dull white in colour, and finer than Broach. The ginning outturn is 26 per cent. It is sown from the middle of August to the middle of September and is ready for picking by the end of February. Picking continues until the end of April.

Dharwar-American. (2) Another old variety called Dharwar-American, or saw-ginned Dharwar (Indian name, Vilaiti or Firangi Hatti), with a staple of $\frac{1}{2}$ inch, of a pearly-white colour, and fine fibre. Its ginning outturn is 29 per cent. Sowing commences about the middle of September and lasts till the end of the month. The cotton is ready for picking by the end of February and is picked until the end of April. This type is sometimes sown as a Kharif crop from the beginning to the middle of June, in which case it is harvested in December.

Broach. (3) A third, and new, variety is called Broach cotton (Indian name, Bhaddock Hatti), and has a staple of $\frac{3}{4}$ inch and a pure white colour. Its fibre is fine and silky and it has a ginning outturn of 33 per cent. Sowing takes place between the end of June and the middle of July, and the cotton is ready for picking by the end of February; picking continues until the end of April.

Cambodia. (4) Another new variety is known as Cambodia (Indian name, Cambodia Hatti). The staple is $\frac{1}{2}$ inch in length, its colour is pure white, and it has a fine and silky fibre. The ginning outturn is 36 per cent. or even higher. Sowing is effected between the middle of September and the end of the month, and picking takes place between the end of February and end of April.

Prices. The following is a comparison of the prices of these four varieties on the same day :—

Per naga of 1,344lbs. of seed cotton.

(1) Kumpta	Rs. 139
(2) Dharwar-American	Rs. 141
(3) Broach.....	Rs. 200
(4) Cambodia	Rs. 200

Method of Cultivation. All the varieties are sown by drills in rows 18 inches apart. The crop is very thick in the rows and irregular. The system of thinning out when the plants are young, except in the case of Broach, is not observed in this division. The Department of Agriculture has recently demonstrated the advantage of better drills and of thinning out the crop. The distance between the rows which is recommended by the Department is 24 inches.

The first hoeing is given when the plants are about 4 inches to 6 inches high, three or four hoeings are given afterwards, till the crop is ready, according to rainfall. Hoeing operations are not undertaken when the fields are wet. If the late rains are short, repeated hoeings are given to conserve moisture.

As I have already mentioned, there is no practice of thinning the local cotton; but for Broach thinning is done when the plants are about 6 inches high. The Department is also demonstrating the advantage of pruning plants, especially the Broach cotton plants, and this is being taken up by the cultivators. Pruning is done when the plants are about 1 foot high or about six weeks old. Some doubt has been thrown on the commercial value of pruning.

Cotton is mostly grown as a main crop. Sometimes it is mixed with castors, rabi jowar, til, and linseed. Ambadi and Bhendi are found in small proportions. Sometimes in places where the rainfall is certain, a pulse crop, viz., Kulthi (horse gram) is sown along with the cotton seed in the same row. The Kulthi is harvested early, and the cotton is left alone afterwards. In tracts of heavier rainfall, in the Belgaum District, cotton seeds are dibbled between the Chilli plants, which are planted in rows 2 feet apart each way. The intercultivation and other operations are the same as for Chillies. The Chilli crop is harvested in October, when hoeings are done both ways.

Rotations of Crop.

A three years' rotation of cotton, wheat, and jowar is considered to be the best, but at present only a two years' rotation, cotton with jowar or cotton with wheat, is practised, as the cultivators think it too long to wait for three years for the money crop, which is cotton. There are several villages where Dharwar-American cotton is grown continuously without rotation. This is only the case with Dharwar-American cotton, which grows well without rotation, with the application of a little manure. The Kumpta cotton does not grow well on the same land without being rotated with another crop, even though it may be manured. Therefore, a two years' rotation, cotton and jowar, is strictly observed with Kumpta cotton.

Yields of Cotton.

Below are given the yields of the different cottons grown in this tract :—

Kind of Cotton.	Maximum yield per acre in lbs. Seed Cotton.	Average yield per acre in lbs. Seed Cotton.
1. Kumpta	600	300 to 350
2. Dharwar-American	700	350 to 400
3. Broach	750 to 800	400 to 450
4. Cambodia	550	300 to 350

Insect Pests. The cotton boll worm attacks the Kumpta and Broach cottons and the red cotton bug infests the American variety.

The Department of Agriculture advises that the cultivator should grow trap crops, such as Bhindi (lady's finger) for the boll worms, and that basins half-filled with kerosine oil and water should be placed in the fields for catching the red cotton bugs. As the damage is not serious, the cultivators do not follow this advice to any extent.

Profit from Cotton-growing. The net profit from the cultivation of cotton is about Rs. 25 to Rs. 30 per acre in the case of the ordinary local varieties, viz., Kumpta and Dharwar-American. Broach cotton yields a profit of Rs. 8 to Rs. 9 per acre in excess of Kumpta and Dharwar-American. Cotton gives a greater net profit than other crops, as the expenses of cultivation and the price of the cotton seed are less than for other crops. There is a difficulty in getting sufficient female labour at picking time, and male labour at the time when the cotton sticks should be uprooted.

Land Tenure. The average area of a holding in the district is $22\frac{3}{4}$ acres; Government is the owner, and the tenants keep possession as long as they pay the Government assessment.

The value of cotton land is from Rs. 150 to Rs. 250 per acre. In the proximity of large towns like Dharwar and Hubli the price is about Rs. 250. In remoter villages the price is about Rs. 150.

The annual rent of cotton land is from Rs. 8 to Rs. 15 per acre.

Rs. 3 to Rs. 3-8-0 per acre are sufficient to cover the Government taxes.

**Government
Experimental
Farms.**

The following Government farms are located in the district : 1, Dharwar ; 2, Gadag ; 3, Gokak. There are no special seed farms, but the above farms are used for the purpose of seed distribution. It is evident that the seed distribution is not on a sufficiently large scale, and a Government official informed me that there is no special system of seed distribution in force, such as the Central Provinces possess. Cultivators get their seed from the "dalals" through whom they sell their kapas, or from local petty seed merchants who buy cotton seed in the season and sell it at sowing time. But recently the work of distributing cotton seed has been taken up by a few organised bodies, such as Agricultural Associations and Co-operative Seed Societies, who supply large quantities of pure cotton seed to their members and also to outside cultivators. The district officers of the Agricultural Department select the best cotton crops from good localities, and the produce from the first and second pickings are ginned separately for seed purposes. The ginning operations are carried out under the supervision of the officers of the Agricultural Department. The seed thus obtained is sold at sowing time, at 2lbs. or 3lbs. less per rupee than the prevailing rates in the bazar. Similarly all the seed grown on the Government farms is distributed among members of the Agricultural Associations and Co-operative Societies.

**Dharwar
Government
Farm.**

On the *Dharwar Government farm*, which is well managed, the following Indian cottons are grown experimentally. They are fairly representative of the whole of India :—

Rozi (*G. obtusiflorum*).—A perennial cotton, grown in rows of 5 feet apart, with cereal crop in between. The plant is pruned back to the soil every year. It has a harsh inferior fibre, and is grown in the north of Gujarat on light soil. Only very small quantities are produced ; staple $\frac{5}{8}$ inch. White.

Nadam.—Botanically same as *Rozi*; grown in Madras on light soil.

Deo Kapas (*G. arboreum*).—This is a tree that is usually grown near temples. The cotton from it is used for spinning the sacred thread.

Broach (*G. herbaceum*).—Grown in Broach, and latterly in Dharwar.

Ghogari.—Noted for high ginning out-turn, is of a bright white-colour, but its staple is shorter than that of Broach ; grown in north of Broach district.

Wagad (*G. herbaceum*).—An annual grown in Ahmedabad and parts of Kathiawar ; it is hardy and resists the frost. The bolls are collected in the field and taken to the houses, where the cotton is picked.

Bani (*G. indicum*).—Grown in Hinganghat, Central Provinces ; an annual ; fine beautiful fibre, full inch, but possessing only 27 per cent. ginning outturn and a small yield per acre. It has a special soapy feel.

Jari (*G. neglectum*).—Grown in Central Provinces, Kandesh, Deccan, United Provinces. This neglectum variety is the most widely distributed cotton over India.

Mathio (*G. neglectum*).—Grown in Kathiawar, and has been substituted for that formerly well-known Dhollerah cotton. It is very poor, but has a high ginning out-turn and matures early.

Warhadi (*G. neglectum roseum*) has a high ginning out-turn and yield per acre, is early maturing, $\frac{3}{8}$ inch fibre, coarse, very bright, liked for export, grown in Central Province and Kandesh.

Comilla (*G. cernuum*).—Grown in Assam on Kil Hills, Garo Hills. Very large ginning out-turn, 50 to 51 per cent., poor staple and coarse.

Kumpta (*G. herbaceum*).—South Maratha; good fibre and good staple, $\frac{3}{4}$ inch to $\frac{7}{8}$ inch, strong, but dull. Low ginning out-turn, 27 to 29 per cent., fair yielder. This cotton is being replaced by the Agricultural Department by Broach. A great deal of dirt is always in the picked cotton.

On the Dharwar farm a $6\frac{1}{2}$ h.p. Blackstone oil engine is kept. It is portable, and can be moved by one bullock. Its price was 1,600 rupees loco-Dharwar. The oil engine is principally used for driving a pump that lifts water from a depth of 30 feet. During the ginning season this engine works a few small roller-gins on the farm, which turn out 34lbs. lint in one hour.

The Dharwar farm has 130 acres, 70 of which are under cotton. It is an experimental farm for selection and hybridising and making manurial, tillage, and rotation experiments. I was told that the Government does not aim at making it self-supporting, which is, I think, an error, and if proper seed farms were added, I am convinced the whole undertaking might be made self-supporting, as is the case in the Central Provinces.

The best *manuring experiments* on the Dharwar farm are obtained with "*poudrette*," but here again difficulties to its adoption, owing to caste, arise. I was told that the cultivators of sugar cane in the Poona district had sunk their aversion to "*poudrette*," but no doubt many years will elapse before the cultivators in the Dharwar district will follow their example.

Gadag Government Farm. A very interesting demonstration in favour of ploughing, for districts where the rain is uncertain was shown at the Gadag Government Farm. There were, side by side, one field prepared by the usual native scraper, and another ploughed with a steel plough to about 5 inches deep. Both fields were planted with Cambodia cotton, and the difference in crop in favour of the ploughed field was most marked. The superintendent of the farm thought it would yield 60 per cent. more than the field which had only been scraped. The preparation of the good field was one ploughing in May before the rains, and 13 harrowings and one rolling afterwards; the inter-cultivator was used five times. The other field had been scraped five times in October, and received three inter-cultivations. Cambodia is making good headway all along this district, and the farmers affirm that

Cambodia is a much better paying crop than Dharwar-American, which has been established here for many years. The yield of Cambodia is, however, small in comparison with the yield in Madras, being only 400lbs. seed cotton per acre. Dharwar-American yields only 200lbs. seed cotton. The ginning out-turns were 38 per cent. Cambodia and 29 per cent. Dharwar-American.

Hulkati. Some six miles from Gadag is situated a village called *Hulkati*. The cultivators of this village are growing nothing but Cambodia cotton; they have bought an oil engine, and now gin their cotton themselves in order to keep their seed pure. These cultivators are extremely careful and intelligent. They recognise the advisability of proper treatment of the seed, and there seems to exist the spirit of co-operation, evidenced by the purchase of the oil engine and gins.

Takavi. I was informed by an official of the Government that complaints are made by cultivators as regards the administration of the Takavi fund.

Co-operative Credit Societies. There are 75 Co-operative Societies in the Dharwar district, which are being induced to take up the distribution of cotton seed. Money is advanced by them to cultivators for the purchase of seed, manure, bullocks, and also for the improvement of land. The interest is 9 per cent. and the amounts advanced are small, and personal security or security on property is required.

Ginneries. There are more than 100 ginning factories in the three districts of Dharwar, Belgaum, and Bijapur. Some of these factories use saw gins for ginning Dharwar-American cotton. The rest use Macarthy double-roller gins for ginning Kumpta cotton. Recently a few single-roller gins have been introduced for ginning Kumpta cotton. In some places Dharwar-American cotton is ginned by double roller gins, as the staple is cut in a saw gin, and consequently becomes shorter.

Many of the saw-gin factories are worked by oil engines. The double-roller ginning factories are mostly worked by steam engines. There are, however, a few factories with four to six gins worked by oil engines.

The seeds of each lot of cotton are not kept separate in the ginning factory.

There are a few big factories owned by European firms, but most of the ginneries belong to Indian Joint Stock Companies. The small factories, worked by oil engines, belong to individual owners. Many of them are cultivators in villages. A few millowners of Ahmedabad have their own gins at Hubli and Gadag where they gin the "kapas" bought through their agents. The millowners formerly bought ginned cotton, ginned by middlemen, but they found the lint cotton to be of inferior quality, and for this reason they are now buying kapas which they gin in their own factories.

There are 16 bale presses in the district, producing bales of from 300lbs. to 400lbs., for which Rs. 3-8-0 to Rs. 4 per bale of 392lbs. is charged. The bales are hydraulically pressed.

**Saw-gins
versus
Roller-gins.**

At Hubli I inspected, two years ago, a few ginning factories which had both saw and roller gins. American cotton adheres firmer to the seed, and therefore saw ginning is considered necessary by the ginners of this district. Roller-gins remove linters as well from the seed, only it is necessary to run the rollers more slowly when ginning American cotton than when ginning Indian cotton. The saw-gins which I inspected were made by the Eagle Gin Company, Bridgewater, Mass. The shaft had 24 saws only, a fan blew the ginned cotton into an adjoining room, where it was collected and packed into loose bales. I had one and the same kind of cotton ginned by a roller-gin and a saw-gin. Certainly the saw-gin process turned out a much cleaner cotton. Hardly any impurities were left in it, whilst the roller-gin did not remove many of the impurities, such as parts of capsules, leaves, &c., but the staple of the cotton ginned by the roller-gins seemed to me considerably stronger. The Eagle saw-gin turns out about 30 per cent. more cotton than a roller-gin. I was told that *all* the Dharwar American cotton is ginned by saw-gins, and that formerly Macarthy roller-gins had been in use, but owing to their low ginning capacity they had been entirely superseded by the Eagle gins. The cost of an Eagle saw-gin, with 24 saws on a shaft, placed at Hubli, is 350 rupees. Each gin requires 1 h.p. The cost of the double roller-gin placed at Hubli is 450 rupees. The price of ginning is 8d. per 28lbs. of lint (28lbs. are here called a maund), for Kumpta cotton on the double roller-gin, and 5¼d. per 28lbs. lint for Dharwar-American on a saw-gin.

The wages are 4½d. per 10 hours for women at the gin and 6d. per 10 hours for men for heavier work. At the height of the season 6d. and 9d. respectively are paid.

A native gentleman who showed me round various ginning factories told me that he could well remember Dharwar cotton being picked quite clean some 20 to 30 years ago, but owing to the fact that the wages are now paid on the quantity picked, the natives have become careless, and aim solely at a large weight.

One roller in a gin will last one season (about 100 days). When the grooves are made by hand they need not again be touched for four days, but when they are made by machinery they must be renewed once per day.

The bale presses are quite modern and up to date. Steam pressing at Hubli is charged at 4 rupees per bale. Usually the bale is pressed twice, first into what is called half-bales and then by the finishing press into export bales. I saw no watering done before pressing. The press turned out about 150 bales per day; the charge of 4 rupees per bale is inclusive of pressing, canvas, and hoops.

In order to remove more dust and impurities from ginned cotton, it is customary in this district to shake and beat it on a frame which is covered by a lattice work made of iron hoops. I have never seen cotton that was so freely mixed in the picking with dirt and impurities as in this locality. In one of the presses I saw a number of women mixing two different qualities of cotton by throwing the cotton into the air. It is here where waste cotton from the spinning mills is mixed with the seed-cotton for the purpose of deceiving the spinners abroad.

Gadag has a cotton market. It differs from that of Akola in that each broker has his own store. All the stores are situated in one long street; in nearly every one there was some considerable quantity of cotton from last year's crop.

Mixing and Watering of Cotton.

The two varieties of cotton, Dharwar-American and Kumpta, are intentionally mixed in certain proportions to get better colour and ginning out-turn. The newly introduced Broach kapas is mixed with Kumpta kapas before ginning and the mixed lint thus obtained is sold in the Hubli market under the name "Dharwar-grown Broach." Old cotton, or sometimes cotton waste, is mixed with good cotton and then baled; this is done solely for cheating purposes. According to information received from a Government official, the cultivators are in the habit of sprinkling water on the kapas before it is put into bags. Small stones are intentionally put in the centre of the bags to increase the weight. Leaf dirt and soil are purposely added to increase the weight. The prices for Dharwar-American and Kumpta cottons are not always the same. The small merchant mixes the cheaper with the dearer kind in certain proportions and sells the mixture in the name of the dearer class. It is very difficult even for experts to distinguish varieties in mixed lint. Kapas of different varieties can be distinguished easily.

Method of Sale.

The small farmer takes his cotton to the middleman, who has advanced money to him. Interest is charged on the money advanced. Commission is charged to the cultivator by the "dalal" or broker at the rate of Rs. 0-8-0 to Rs. 0-12-0 per naga of 1,344lbs. Besides this commission the "dalal" gets commission of Rs. 1 from the buyer. An allowance of 14lbs., for the weight of the gunny bag in which the kapas is packed, is deducted from each Dokra (bale) of kapas, whereas the actual weight is only about 8lbs. The actual kapas in each Dokra is about 336lbs.

If the "dalal" is the only middleman, he is satisfied with the commission he gets from the cultivators. But if he is a petty dealer in cotton as well as a "dalal," he is sure to take advantage of the fluctuating prices. He would sell the kapas on the day when the prices were high and inform his customer that it was sold on the day when the prices were low.

Kapas is sometimes bought by petty merchants in small quantities. It is ginned in village gins and the lint is sold by petty merchants to big merchants and the millowners. The trick played by the petty merchants lies in ginning. A certain proportion of seed is allowed to be crushed and passed along with the lint, in order to get a higher percentage of lint.

Markets.

The establishment of more official markets, such as exist already, and the wider distribution of selected seed, combined with the use of improved implements and instruction how to make the best use of them, would undoubtedly help on the extension of cotton growing in this district.

IV.—AHMEDABAD-KAIRA OR NORTH GUJARAT DISTRICT.

This tract, comprising the two districts indicated by its name, together with the northern part of the Broach district, is somewhat remarkable in that it grows within a narrow area a number of types in a more or less mixed condition. This is due partly to the black soil occurring in patches and partly to the use of well irrigation. The average rainfall is 30 inches.

Kinds of Cotton.

The four chief types of cotton grown are known to cultivators as *Wagad*, *Lalio*, *Goghari*, and *Rozi*. Commercially they are grouped under the common name of "*Dhollera*." The growth is largely consumed locally in the mills of Ahmedabad.

Wagad is a variety of *herbaceum* differing from the Broach outwardly only in size. The peculiarity with regard to this cotton is that the bolls are bodily plucked from the plants, and the seed cotton is extracted at leisure in the houses of the cultivators. The cotton is of a fair quality, coarser than *Lalio*, but owing to the primitive method of harvesting, *Wagad* contains more dirt and other impurities.

Lalio is identical with Broach, and under well irrigation yields a similar cotton. This kind and the previous one are frequently mixed together.

Goghari is grown unirrigated under the same conditions as an unirrigated *Lalio*. It produces a coarser fibre, but yields better on a short rainfall.

Rozi is a *perennial*, and once sown is left on the land for three or four years. Generally, there is a mixed crop (Cereals) on the same field. The ginning out-turn is only 25 per cent., and the quality of the cotton is also inferior.

The yield per acre in this district varies from 200lbs. seed cotton when unirrigated to as much as 1,200lbs. when irrigated.

The Government farm in this district is situated at Nadiad, but not much attention is given to cotton. Experiments with perennial cotton are still continued there. These require water in the first year to get established; in the second year the trees have given 1,000lbs. seed cotton per acre, yielding about 300lbs. lint, but the third year the yield goes down to 600lbs. The Deputy Director estimates that 2,000 bales of cotton of the perennial kind might be produced in this district. The staple is long, but, as far as I remember, it is very irregular. As I have pointed out in my first report, I cannot see the advisability of growing these perennial cottons, because they harbour insect pests on the stems, and the branches are so brittle that they easily get damaged by the wind. Many experts have again and again expressed the opinion that tree cotton should everywhere in India be given up.

The total area under cotton in this tract is 295,000 acres, and from information which I have received there does not seem to be any great hope of extending cotton cultivation here.

Ginning. The charge for ginning varies from 2 annas to 10 annas per 40lbs. of lint. In the Ahmedabad district there are 12 hydraulic presses, which turn out bales of 400lbs. at a charge of Rs. 2-2-0 to Rs. 2-8-0.

Value of Cotton Land.	The value of good cotton land near Kaira ranges from Rs. 350 to Rs. 800 per acre, whilst land near Ahmedabad is valued at only Rs. 100 to Rs. 300.
Rent.	The annual rent in the former district is Rs. 15 to Rs. 20, in the latter Rs. 10 to Rs. 15.
Government Taxes.	Government taxes in Kaira amount to between Rs. 6 and Rs. 16, whilst in Ahmedabad they are between Rs. 2 and Rs. 3 per acre.
Co-operative Credit Societies.	There are 67 co-operative societies in the two districts.
Sowing, &c.	The time of sowing is July to August, and the cotton is ready for picking from January to March. The seed is sown in drills.
Profit from Cotton	The average net profit to the cultivator is as follows :— Rs.
Growing, &c.	Kaira : Cotton 30 to 40 Other crops 25 to 35 Ahmedabad : Cotton 12 to 25 Other crops 15 to 20
Yield.	The maximum yield per acre is estimated to be 800lbs. of seed-cotton, whilst the average yield works out at 300lbs. to 400lbs. seed-cotton.

V.—THE DECCAN AND KHANDESH TRACT.

The principal districts are Poona with 5,382 acres, Nasik with 81,882 acres, Nagar with 17,816 acres, East Khandesh with 919,331 acres, and West Khandesh with 434,883 acres.

Area under Cotton. The area under cotton has of late increased in this tract, and there are possibilities of further expansion. Cotton is not an irrigated crop in the Deccan and Khandesh tracts.

Ginning Factories. There are altogether 160 ginning factories in this tract, all being furnished with Platt's single-roller gins, except one factory at Kajgaon, which possesses an American Eagle saw-gin. The ginning factories are all owned by

Indians. The charges for ginning are from Rs. 3 to Rs. 4 per Palla of 200lbs. lint.

The seeds of the different lots are kept separate.

There are 69 presses, producing bales of 375lbs. to 420lbs. weight, for which a charge of Rs. 2 to Rs. 3-4-0 is made. They are worked hydraulically and by steam.

The various kinds of cotton are mixed indiscriminately in the gin and press.

I have been informed that occasional damping of cotton is carried on with steam.

Land Tenure. In Poona, Nasik, and Nagar the cultivator is generally a tenant of the Government. In the Khandesh districts about 60 per cent. of the cultivators are the owners of their own land, the remaining 40 per cent. are tenants of large landowners.

Land in the latter districts is worth Rs. 250 to Rs. 500 per acre, whilst in the former districts the value seldom exceeds Rs. 50 per acre.

The annual rent in Poona, Nasik, and Nagar districts varies from Rs. 4 to Rs. 7 per acre, whilst in the Khandesh districts it ranges from Rs. 10 to Rs. 25.

Government taxes are from Rs. 1 to Rs. 3-8-0 per acre.

Seed distribution. The Department of Agriculture has a seed farm at Jalgaon, where a selected strain of *Neglectum Rosea* is cultivated.

The distribution of seed is still carried out in a primitive manner.

Kinds of Cotton Grown. The cottons grown are known by the names of Jari and Varadi, both varieties are sold under the name of Khandesh or Oomrahs. The cotton is of short staple.

The Khandesh cotton consists of six types: Two types of Varadi (*Neglectum Rosea*), $\frac{1}{2}$ inch in staple, white in colour, and coarse.

Three types of Jari, $\frac{5}{8}$ inch in staple, not quite as white as, but slightly finer than, Varadi.

Bani (Hinganghat) with a staple 1 inch in length, dull in colour.

Method of cultivation. The cotton is sown in the middle of June and picked between the middle of October and January. It is sown in drills about 1 foot apart, and the distance on the drills from plant to plant varies from 2 inches to 3 inches. Two to three weedings and four to six hoeings are given. The plants are never thinned out. Tur is sown every eighth or twelfth row in the Deccan district, along with cotton. In the Khandesh districts cotton is mostly sown pure.

The cotton is generally sold by the farmers to the village shop-keeper, who sells it to the larger merchants. The latter send it to the ginning factories.

Insects. The cotton crop suffers from aphides, stem borers and cotton bugs. Wilt is also common in all the districts.

Rotations. Cotton is usually rotated with Bajri.

Profit from Cotton Growing. The average net profit resulting from cotton cultivation is Rs. 10 to Rs. 25 per acre, whilst from other crops the cultivator obtains Rs. 10 to Rs. 15.

Cotton Markets. The Director of Agriculture has proposed the establishment of cotton markets, similar to those in Akola, and this would undoubtedly give an impetus to further extension.

Yield. The following are the maximum and average yields per acre in the various districts:—

	Maximum. Seed-cotton	Average. Seed-cotton
	Lbs.	Lbs.
Poona	480	150-200
Nasik	500	150-200
Nagar	600	200-300
East Khandesh	1,000	300-400
West Khandesh	600-800	300-350

In the Deccan, farm manure is applied in quantities of five to ten cartloads per acre. In the Khandesh districts every third or fourth year about 10 loads of farmyard manure per acre are applied.

NATIVE STATES.

NIZAM'S TERRITORY.

The Nizam's Territory is by far the largest and most populous of the interior states. The majority of the population are Hindoos, although the reigning family is Mohammedan. A year ago a Department of Agriculture was established. The total area sown with cotton last season was 3,653,000 acres, against 2,880,000 in the preceding year, thus showing a substantial increase of 26·5 per cent. This year's yield is estimated at 400,000 bales, against 300,000 bales last year. The Nizam's Territory plays an important part in the supply of cotton in India, representing about 15 per cent. of the total crop. I was unable to visit this native state, and the following information was supplied to me by the Director of Agriculture :—

Kinds of Cotton. In every field there is a mixture of at least three kinds of cotton—

Gaorani. (1) "Gaorani," sometimes termed Bani, is fairly long in staple, of exceptionally strong fibre, and is an indigenous cotton. The percentage of lint to kapas is 28·22.

Nambhri. (2) Growing mixed with Gaorani in the fields is a completely different species. Nambhri may be distinguished from a distance on account of its broad leaves standing out distinctly from the narrow-leaved Gaorani. The staple of Nambhri is good, but the fibre is very weak. It is never grown by itself.

Bharat. (3) A more difficult species to discover in the mixture is the "Bharat," which, till it matures, resembles the Gaorani in almost every respect, but the cotton is very white, and the kapas, on the opening of the bolls, does not spread outwards, but hangs down almost perpendicularly. It is coarse, has a very short staple, and is weak. The percentage of lint is 32·78.

Of the three cottons the first is undoubtedly the best, it has a long staple, strong fibre, and is glossy; but the other kinds, although inferior, are sold as seed cotton at the same price. For this reason the cultivator cannot be induced to grow "Gaorani" separately. Watering of seed cotton is quite a common practice, and pure Gaorani turns yellow when watered. Bharat does not show the adulteration, it keeps its colour after watering, and becomes, indeed, softer. So long as Bharat is grown in sufficient quantities to serve the purpose of mixing with Gaorani, in order that both may pass as Gaorani, it will pay to grow Bharat, and the ryot will receive for the inferior kapas a price above the much superior Gaorani. When, however, the limit is reached conditions are reversed.

His report adds: "The admixture and adulteration are at present so barefaced that honest dealing in Parbhani spells ruin to the man who will dare to attempt it. It was a hot dry time of the year when I walked around the different factories near the town: the dust started up in tiny clouds with every footfall, yet in every factory it appeared to have rained heavily wherever the bags of lint appeared. To the query why the cotton was thus soaked, the smiling reply was 'weight.' The ginners and pressers who do not deal in cotton must conform to this rule, or the merchants carry their cotton to be ginned and pressed where they can obtain the benefit of this—well, why not call it by its real name—fraud."

The Director proposes that the State should help to put down cotton frauds and establish markets in order to restore the name of Hyderabad cotton. Such measures are easier to introduce in Native States than in British India, where the susceptibilities of politicians have to be considered.

CENTRAL INDIAN AGENCY.

The Central Indian Agency includes altogether 150 Native States, Gwalior, with a population of 3 million people, being the most important. The total area under cotton last season was 1,426,000 acres, against 1,314,000 in the preceding year. The estimated outturn is 273,000 bales, against 206,000.

Recently an Agricultural Department has been established at Indore.

MYSORE.

Mysore has about 93,000 acres under cotton cultivation. A decrease of about 60,000 acres has taken place since last year. The Department of Agriculture at Bangalore is under the direction of a European agricultural expert, and experiments with Cambodia and other cottons are being carried on. Co-operative Societies have made good progress in Mysore.

RAJPUTANA AGENCY.

Rajputana Agency includes 21 Native States. About 470,000 acres (against 393,000 in 1912-13) were under cotton cultivation in 1913-14. The yield is estimated at 132,000 bales. The principal States are Jaipur, Jodhpur, Bikaner, Udaipur. Some of these levy a duty on all cotton leaving the States; a difference in the rate of export duty is made in favour of cotton which is ginned and pressed in the State. This duty is, of course, a disadvantage, as it renders competition with cotton grown outside the State more difficult, but the Government of India does not wish to interfere, as the export duty is a question of internal administration.

BARODA.

The State of Baroda includes five or six large and a considerable number of small separate areas, widely scattered.

Gujarat and Kathiawar. The area covered by this Native State is about 8,000 square miles. The population numbers 2,000,000, and the annual revenues are slightly over £1,000,000 sterling. During last season cotton was cultivated on 749,384 acres.

The Gaekwar displays a deep interest in the welfare of his subjects, especially in their education. He is undoubtedly one of the most advanced Rulers in India, takes a keen interest in the government of his State, and during my visit he delivered an address, dealing with the advantages of co-operation and the work it will accomplish for the improvement of agriculture, to 500 ryots, on the occasion of an Agricultural Show. The railway fares of the ryots were paid by the Government, who also provided food without charge.

Agriculture has been helped by means of seed depôts, by the employment of specialists, and by various arrangements for instruction and demonstration. Three agricultural banks were established in 1899 and subsequent years, and two organised in 1910-11 brought the total to five; their operations have been on a rather limited scale, the working capital in 1912 amounting to £11,300. Considerable progress has, however, been made under a Co-operative Credit Societies Act passed in 1905; at the end of 1911-12 there were 122 societies, with 2,815 members, and a working capital of over £13,000.

The Co-operative Credit Societies control 60,000 acres in the cotton area; of these, about 20,000 acres are under cotton, and the seed produced will be used for the distribution amongst the members of the Societies.

There is a Department of Agriculture in Baroda, which is very ably superintended by an Indian gentleman, Mr. M. M. Sitole, B.A., M.R.A.C.

The Devan, Beharda V. M. Samarth, the Prime Minister of the State, also takes a keen interest in agriculture, especially in cotton growing. This is, no doubt, largely the cause of the great progress which has been made.

Geographical Notes. There are four distinct districts in which the cultivation of cotton is carried on, viz. :—

(1) Baroda, bounded on the North by Khera, on the South by Broach, on the East by Panch Mahl, and on the West by Broach and the Bay of Cambay.

(2) Kadi District bounded on the North by the Palanpur Agency, on the South by Ahmedabad, on the East by the Mahikanta Agency, and on the West by the Viramgam District.

(3) Nausari District, surrounded on all sides by Surat and the Kandesh District.

(4) Kathiawar possessions, which are all scattered.

1.—BARODA DISTRICT.

The area under cotton is as follows :—

Type of cotton.	Areas in acres.
Kanmi	52,099
Goghari	104,199
Broach proper	173,666
Rozi	17,366
Total	347,330 acres.

Kanmi. *Kanmi* is very similar to Broach, and is generally sold in Bombay as “good Broach”; the length of the staple is $\frac{3}{4}$ inch. *Kanmi* is white, somewhat glossy and soft, but is not so strong as Goghari; it grows on the black soil. The ginning out-turn of cotton raised by cultivators is 33 per cent., but owing to seed selection the Baroda Government Farm has been able to raise it to 40 per cent. The cultivators’ crop varies from 250 to 400lbs. of seed cotton per acre.

The usual crop rotation adopted is, cotton one year, fallow the next, and cotton the third. If the land is allowed to lie fallow one year the cultivators are able to raise 400lbs. of seed cotton per acre, but if the land is cropped with millet instead of lying fallow the average yield of the following cotton crop is only 200 to 250lbs. of seed cotton per acre.

Goghari. *Goghari* is also very similar to Broach, but the length of staple is only $\frac{1}{2}$ inch. It has a glossy and a very strong fibre, somewhat coarser than Broach, but the ginning percentage is 35 to 38 per cent., which is a distinct advantage.

Goghari is mixed in the ginnery, and by farmers, and passed off as Broach cotton. The yield is the same as of *Kanmi*.

Broach Proper. *Broach cotton proper.* This is grown on the black cotton soil in the southern part of Baroda, adjoining the Broach district. The lint is finer than *Kanmi*, the fibre is glossy, $\frac{7}{8}$ inch to 1 inch in length, and white. The yield and ginning out-turn are the same as of *Kanmi*. The custom of leaving the field fallow for one year after cotton is also adopted.

Rozi. *Rozi* is a perennial cotton grown in the north and north-west of Baroda. In the first year these cottons do not yield any lint, but from the second to the eighth year from 240 to 400lbs. of seed cotton per acre are picked. The plants are 10 feet by 6 feet apart. The lint is very soft and white, and the fibre resembles that of *Kanmi*; the ginning out-turn is, however, very low, averaging only 20 per cent. The trees are pruned down to about 4 inches from the ground at the end of every season. After the rains new shoots appear; *Rozi* is an early ripener.

Bajri and Tur are grown between the rows.

The cultivators on their own initiative tried Cambodia cotton, but owing to the insect pests from the perennial plants it failed hopelessly.

In several places the cultivators have given up Rozi, and are growing a mixture of Kanmi, Goghari, and Broach, as well as a few stray plants of Rozi. They are rotating the cotton with Bajri and Tobacco. Cotton is planted every third or fourth year. The yield is from 300 to 600lbs. of seed cotton per acre. The ginning out-turn varies very much, owing to the presence of Rozi in the mixture.

All cottons are sown, by drills, in lines.

2.—KADI DISTRICT.

The area and types of cotton grown are :—

Wagad	81,765
Lalio	27,255
Cambodia	1,200

Total 110,220 acres.

Wagad. The Wagad cotton is the one generally cultivated, but the bolls do not open in the fields, and they are, therefore, cut off, and the cotton is picked in the farm-yards; the husks of the bolls are given to the cattle. The fibre of Wagad is similar to Kanmi, but the yield is 1,200lbs. of seed cotton per acre, and its ginning out-turn is 35 to 38 per cent.

The crop is regularly irrigated, and heavily manured with cattle manure. It may be said that it is treated as a garden crop.

Lalio. Lalio cotton is grown to a very small extent in parts adjoining Viramgam, in which district it is indigenous; the crop is grown on irrigated and non-irrigated soils. In the former case the yield is about 1,200lbs. of seed cotton per acre, and in the latter 400 to 600lbs. Lalio, when irrigated, requires a considerable amount of manure. The ginning out-turn is 35 to 40 per cent., and the fibre is similar to Kanmi.

Cambodia. Cambodia cotton has lately been grown as an irrigated crop, the yield from the fields of good cultivators was as high as 2,000lbs. of seed cotton per acre. On the Government farm at Jagudan this season, at the time of my visit, 857lbs. per acre had been picked, and about the same quantity was still to be harvested. There is no doubt that Cambodia will be grown extensively in this tract.

Cambodia matures much earlier than Lalio; the first picking commences in November, whilst Lalio is not ready before January. As frost occurs about every third year, from the middle of January to middle of February, it is most probable that Cambodia will replace Lalio; moreover, Cambodia is a hardier plant.

The fibre of the Cambodia grown here is quite white, hardly 1 inch long, strong, but soft; a premium of Rs. 2 above Lalio was paid last year per maund of 40lbs. of lint.

3.—KATHIAWAR.

Kathiawar is the peninsula between the Gulf of Cutch and the Gulf of Cambay. The types of cotton and their respective areas are :—

Mathio	111,069
Kadio and Mathio mixed	5,845

Total 116,914 acres.

Mathio.

Mathio cotton has a staple of $\frac{1}{2}$ inch to $\frac{3}{4}$ inch, is somewhat bluish and coarse, with a yield of 100lbs. of seed cotton per acre, and a ginning out-turn of 28 to 29 per cent.

Lalio was grown extensively up to 1900, when a famine occurred, and since then Mathio has taken its place, owing to its earlier maturing properties. There is only one picking, which takes place in December/January.

Kadio.

Kadio cotton is a Georgian type, with a naked black seed, the fibres hardly adhere to the seed. The lint is very fine, is as good as the best Nausari, very soft, of good colour, and about 1 inch long. Kadio is grown only in the Kodinar district, adjoining Junagar State.

This cotton is often grown mixed with Mathio, as in case of a low rainfall the latter will do well, whilst in seasons of heavy rains the former flourishes. The yield is 100lbs. of seed cotton per acre, and the ginning out-turn 33 per cent.

No manures are used.

4.—NAUSARI.

The types of cotton and their respective areas are as follows :—

Broach	173,639
Surat-Farm-Hybrid	1,278

Total 174,917 acres.

Broach.

In the northern and western part of Nausari Broach is grown. This is the real Broach, or Surat, with a fibre 1 inch long, white, soft, and strong; the yield varies from 100 to 300lbs. of seed cotton per acre, and its ginning out-turn is 30 per cent. Rice and cotton are rotated; rice is manured, and the cotton following has the benefit of the residue.

Nausari.

In the southern and eastern parts of Nausari, facing the Arabian Sea, Nausari proper is grown. The yield is 150lbs. of seed cotton per acre, in rice-producing land. The ginning out-turn varies from 30 to 32 per cent., the length of fibre is 1 inch to $1\frac{1}{4}$ inches. It is silky, fine, and stronger than Broach. This is the cotton which has, until recently, been considered the best in India, but some of the superior Cambodia cotton seems to be more appreciated.

**Baroda
Department
of Agriculture.**

The Department of Agriculture has three farms, viz. :—

Baroda, with a total acreage of 80 acres
—20 acres under cotton.

Jagudan, with a total acreage of 20 acres
— $2\frac{1}{4}$ acres under cotton.

Fort Songhad, with a total acreage of 35 acres
— $5\frac{1}{2}$ acres under cotton.

The Department also supervises 3 demonstration plots on hired land.

After I had explained to the Divan the advantages of seed farms, and the method of distribution adopted in the Central Provinces, he at once instructed the Director of Agriculture to proceed there, and make himself acquainted with all the details. He fully realised the advantage of having a large nucleus seed farm, and the necessity of the Government obtaining almost a monopoly in the sale of seed.

I spent the whole day on the Government farm at Baroda, and cannot speak too highly of the manner in which the cotton was cultivated. The excellence of the Cambodia cotton, especially, appealed to me. The experiments undertaken with regard to manure tests, and early ripening, as well as the exhibition of improved agricultural implements, deserve special mention. Although the disc harrow had only been introduced last season, I was told that it had already become popular amongst the cultivators. Thirty-four iron ploughs had been sold during last season.

ASSAM.

Assam proper, or the valley of the Brahmaputra, is a level plain in the north-eastern corner of the Indian Empire. On the north it is bounded by the Himalayas, and on the south by the Assam mountain range. Between the mountain ranges extensive plateaux are situated, which are known by the names of the tribes who inhabit them, viz. : Southern Garo, Khasi, Jaintia, Cachar, and Naga Hills. On the southern side of the Assam range of plateaux lies the Surma valley, which is at a much lower level than the plateaux. Except for a few hills, the whole valley is a vast deltoid stretch of country covered with a network of slow-running streams, and liable to deep flooding after rains; indeed, during the rainy season it is practically under water. Assam is exposed to moisture-laden winds from the Bay of Bengal, and the climate is decidedly damp. The heavy spring rains and the moisture-laden atmosphere throughout the year are very favourable to the growing of rice and tea. Assam abounds in forests; but, in the plains, cultivation has largely displaced them. The density of population is 406 persons to the square mile in the Assam valley, 126 in the Brahmaputra valley, and 34 in the hills. In consequence of the luxurious vegetation the natives of Assam have become very independent, and they cannot be classed among the world's hard workers. Owing to their independence, as well as to the small population, it is necessary to import labour into Assam for the plantations. The soil of the Kamrup plain seems to me to be the most fertile, and capable of producing almost any crop.

Garo Hill Cotton.

Assam, up to the present, may be considered a negligible quantity so far as the world's cotton supply is concerned. Most of its cotton is grown on the hill-sides, and is known by the trade as "Garo Hill cotton." The average yield is 160lbs. of lint, but as much as 280lbs. has been picked on one acre. The great advantage of this cotton, which is coarse, is that the ginning outturn is as high as 50 per cent. The cotton is purchased by ginning firms situated outside the province, who send agents to the various places; sometimes even the cultivators carry the cotton to the markets. The hill districts are not connected by railways; for this reason the Department of Agriculture has not been able to undertake any work there, and the cultivation of the hill cotton is, in consequence, still carried on in the most primitive way. Owing to its coarseness, this cotton is used principally for mixing with wool. The method employed in cultivating cotton in the hill districts is to burn down whole sides of a mountain, and sow, here and there, a few seeds of cotton along with other seeds. The cotton plants are allowed to remain in the ground for a few years, and when the soil begins to lose its fertility the cultivators migrate to another hill, and repeat the process.

It has been always maintained that the climate of Assam is much too damp for the growing of finer and longer cottons than those of the Garo hills.

The Brahmaputra valley, which is the only possible tract that can be taken into consideration for cotton cultivation proper, has at

both ends of it a rainfall of 100 inches, and in the centre of about 70 inches per annum. Assam can boast of a district, Cheera Poonjee, that has 500 inches of rainfall in the year.

Rungia Estates. Small areas of Egyptian cotton and of Buri cotton have been grown by a Company called the Rungia Estates, Ltd., which owns considerable areas of land (30,000 acres) in the Kamrup plain. The Eastern Bengal State Railway passes through the Kamrup district, and one of the Rungia estates—Hossang—is situated 5 miles from the Patimari Station.

As Hossang is within easy reach of Calcutta, I went there, having had a certain interest aroused by the excellent reports expressed by Lancashire spinners on the samples received in the previous year.

Excellent Buri Cotton. About 5 acres were grown with Buri cotton, and a few acres with Sakellaridis and Joanovitch. Owing to the death of the plantation manager, the cultivation was very much neglected, but in spite of this the Buri cotton was exceptionally fine, silky and strong. The length varied very considerably from $\frac{7}{8}$ inch to $1\frac{1}{8}$ inches. I took 112lbs. of this cotton to Cawnpore, and Mr. S. M. Johnson, the managing director of the Muir Mills Company, Ltd., reported on it as follows: "The cotton is very fine indeed, and at current market prices would fetch at least Rs. 30 a maund, landed in Cawnpore. It could certainly spin up to 60's. The ginning percentage is 32." This cotton had been sown broadcast, and no intercultivation (loosening of soil) had been undertaken. I think that if proper attention is given to planting, weeding, and cultivation generally, Buri cotton could be grown there with great success. The varying length of staple, as shown in the sample I picked, will probably disappear when the cultivation is properly taken in hand. The ginning outturn of the sample lot which I took to Cawnpore was 32 per cent., not at all a low figure, but this could probably be increased through selection in the field and occasional fresh importation of seed. As the cattle had broken into the cotton area and had damaged the crop, it was impossible to ascertain the yield per acre, but from information I have since received, it appears that, even under the adverse conditions described, the crop was not below the average yield in other cotton-growing provinces.

Egyptian Cotton. An experiment made with Egyptian cotton this year has proved an absolute failure. Whether this was due to bad cultivation, or to other circumstances, I could not ascertain. The few bolls of Egyptian cotton which were on the plants certainly showed an excellent fibre, $1\frac{1}{2}$ inches in length, and silky, but I do not hold out much hope of success with Egyptian cotton, as its cultivation is more difficult, and it is dependent upon rain falling at the proper times.

Picking Season. The Kamrup district has an average rainfall of from 70 inches to 80 inches annually, but, from the middle of October to the end of December, there are usually no rains, therefore, if this is made the picking season there is no reason why Buri cotton, if planted about the 15th April,

should not mature by the middle of October. The proper time of sowing will, of course, have to be ascertained by experiment.

I was pleased to see that the Imperial cotton specialist had given, a year previously, the same favourable opinion on the possibilities of Buri cotton. Until recently the opinion was held by all Government experts that no other cotton but "Garo Hill" could be grown in Assam, but the experiments undertaken during the last few years by the Rungia Estates, Ltd., have proved the possibility of cultivating cotton similar to Good Middling American in the Kamrup district, provided thorough cultivation is given.

When the manager of the Hossang Estate was sowing the Buri cotton, he was told by some of the older inhabitants that about 30 years ago a great deal of land was planted in Assam with cotton of a similar kind.

As both the Director of Agriculture of Assam and the Deputy-Director had told me, at the meeting of the Board of Agriculture in Coimbatore, that none but the Hill cotton could be produced, and that it would not be worth my while to visit Assam, I thought it wise, after my experience, to travel to Shillong, the seat of the Assam Government, in order to convince the officials of the wrong impression they had formed. I also had an interview with His Honour the Chief Commissioner, Sir Archdale Earle, K.C.I.E., and he was astonished to see the excellent samples of Buri cotton produced in his Province. It was agreed there and then that the Department of Agriculture, although overburdened with other work, should undertake experiments with Buri and Cambodia cotton. Buri cotton seems to me the most suitable, as it has been proved to be both damp- and wilt-resisting. It is an Upland type of cotton that has become acclimatised in the Central Provinces, and it is referred to in the description of conditions in that province.

The soil in the Kamrup district is a rich alluvial deposit, and was probably the bed of the Brahmaputra river, which at one time must have flowed through this country.

Rubber. The principal crop on the Rungia Estate is Brazilian rubber, planted on about 200 acres.

Most of the rubber trees are 3 years old, and tapping will be started this year in the rainy season. The trial tapping of a few trees last year proved very satisfactory, and the bark of tapped trees had healed up remarkably well during the five months that had elapsed since the incision was made.

Flax. Flax (Belgian seed) was sown on 18 acres, for the purpose of using the straw in the making of linen fabrics. In India, generally, flax is grown for the purpose of developing the seed in order to obtain a large percentage of oil. Flax grown for the purpose of obtaining the straw takes roughly 100 days to grow, from date of sowing. It is sown thickly and broadcast, but if wanted for seed purposes, cultivation in lines is preferable. The agricultural expert of the Government reported since my visit that the fields looked in excellent condition.

Labour. The labour supply in Assam is, no doubt, a serious problem. The tea planters, with their powerful Association, exercise a domineering influence over all the

other industries. The tea planters were the first to import labour from the plains of Assam, Nepal, Madras, Chota, Nagpur, &c. This labour is imported through special firms, established in various parts of India, and all over Assam the companies send "duffardars," a kind of foremen, to recruit labour. Every new labourer receives an advance as soon as he agrees to hire himself out. The duffardars act always as a kind of foremen over their workers. It is to them that the wages are paid, and in case of disputes they approach the masters. The workpeople are supposed to pay back the advances gradually. The present rate of wages on the Rungia Estate is 6 annas per man. The women and children of the tribes living in the Kamrup plain



Assam Women on a Fishing Expedition.

do not work in the fields, but seem to spend their time fishing in the many dykes that abound in that part of the country.

**Most Fertile
Province
in India.**

The possibilities of Assam are hardly known yet. It is, however, patent to every traveller who visits that country that it is enormously rich in vegetation; and many hold the opinion that Assam is the most fertile province in the whole of the Indian Empire.

**More
Agricultural
Staff
Wanted.**

At present the Department of Agriculture has only one farming expert, who, owing to the diversity of the crops and the long distances he has to cover by train and elephant, finds it quite impossible to study any one crop thoroughly. Besides looking after the various crops he is supposed to train a subordinate staff, but

this, of course, he is unable to do when he is touring in the country. Two additional agricultural experts are most urgently wanted.

The Government has the following farms :—

Shillong—for cattle and goats.

Jorhat—for sugar cane and soil research.

Karimganj—for paddy and jute.

Kamrup—for sugar cane.

Sugar.

The Assam Government is undertaking, at present, experiments in sugar cane cultivation on a large scale, with a view to proving that it would pay an industrial company to build a refinery in the province. As, however, wild elephants, bears, and pigs abound, and they are proverbially fond of sugar, opinions as to the ultimate success of the experiment are divided. 1,000 acres will be grown with cane.

Jute.

A well-known Calcutta firm was on the point of experimenting with the growing of jute, at the time of my visit. There is every likelihood of success for this crop.

BURMA.

Burma, with its dependencies and the Shan States, is **Geographical.** situated in the far east of the British Empire in India, and is bounded on the north-west by Bengal, the protected State of Manipur and Assam; on the north-east by the Chinese province Yunan and the Chinese Shan States; and on the south-west by French Indo-China, Siam, and the Siamese Shan and Malay States.

The total estimated area of Burma is 261,839 square miles, *i.e.*, considerably larger than the German Empire; it is the largest single province of the British Empire. Burma proper covers 164,411 square miles, the Shan States 54,728 square miles, the Chin Hills 11,700 square miles, and the unadministrated territory 31,000 square miles. The three main natural divisions are: Arakan, the Chin Hills and Kachin Hills in the west, the Irrawaddy basin in the centre, and the Shan, Karen-ni States and the Province of Tenasserim in the east.

The greater part of Burma proper is situated within the limits of the Irrawaddy basin. Four subdivisions may be distinguished. There is *first* the highland tract, including the mountainous regions round the sources of the Chindwin river and the upper waters of the Irrawaddy, the Chin Hills, and the Northern and Southern Shan States. The greater part of this country consists of rugged hills, but there are in the Shan States plateaux which are fertile and well populated. The *second* tract, known as the dry zone of Burma, includes the whole of the lowlands lying between the Arakan Yoma and the foot of the hills that rise up to the Shan plateau. It stretches along both banks of the Irrawaddy from above lowlands. This is the cotton growing tract. The *third* sub-division, the Irrawaddy Delta, is a vast expanse of plain, 12,000 square miles in area, consisting almost entirely of a rich alluvial deposit and fertile in the highest degree. The deltoid districts are devoted mainly to rice growing. To the east, the country draining into the Sittang river—consisting of hills in the north and broad fertile plains in the south—forms a *fourth sub-division*. The third natural division of Burma is the old province of Tenasserim, which formed the nucleus from which British rule in Burma has grown. It is a narrow strip of country, mountainous and intersected by streams, lying between the Bay of Bengal and the high range of hills forming the eastern boundary of the province of Siam. In most parts of Lower Burma, and in portions of Upper Burma, the rainfall is abundant and the climate moist and enervating for nearly half the year, but in the dry zone the rainfall is as low as 20 to 30 inches a year. The population per square mile ranges between 124 in the deltoid plains, and 15 in the northern hill districts.

The rivers of Burma are: Irrawaddy, with its chief tributary the Chindwin, the Rangoon, the Sittang, the Salween, and the Mekong.

Irrigation. Lower Burma having a heavy rainfall does not require irrigation; in Upper Burma the Mandalay Canal, the Shwebo Canal, and Mons Canal have been constructed during the last decade. The total mileage of completed canals—of the productive type—is 654.

Agriculture. Burma contributes yearly about £2 $\frac{1}{4}$ millions to the Government of India *in excess* of expenditure incurred, a fact which will no doubt be considered in the future development of the Burmese Agricultural Department.

The principal crops grown are:—

Rice, millets, maize, oilseeds, cotton, tobacco, beans.

The total area cropped during 1911-12 was:—

Upper Burma, 5,092,000 acres.

Lower Burma, 8,127,000 acres.

In Upper Burma almost 2,000,000 acres were devoted to the cultivation of rice, and in Lower Burma, almost 8,000,000 acres.

In 1911-12 the value of the exports of rice from India amounted to almost £10,000,000, and by far the largest part was grown in Burma.

Cotton in Burma is practically restricted to the Dry Zone, which is the central basin, formed at the junction of the Chindwin and Irrawaddy, and to the Hill tracts.

The following table illustrates the steady extension of cotton growing that has taken place during the last six years, according to Government figures:—

Year.	Acres.	Bales of 400lbs.
1908-09	204,000	41,000
1909-10	198,000	32,000
1910-11	167,000	28,000
1911-12	186,000	32,000
1912-13	227,000	45,000*

* The principal press factories assured me that the total exports were 75/80,000 bales, and that these figures could not be taken as correct.

These figures represent cotton with the seeds extracted.

So far as the Department of Agriculture is concerned cotton has been a comparatively neglected crop in Burma; it has been grown principally because it supplied the clothing for the inhabitants; and because, in the main cotton tracts, there was the advantage that it filled a gap in the rotation of other crops, such as sesamum, jowar, and beans. Nowadays, its export value means to the country a sum of £650,000.

The Agricultural Department has up to now devoted its principal attention to the cultivation of rice. So far as cotton is concerned the Department has been unable to devote time and money to it; and if one considers the vast extent of the country and its small staff of experts, viz., one chemist and one agricultural expert for Upper Burma, and one agricultural expert for Lower Burma, the inactivity of the Department as regards cotton will be at once understood. The Deputy-Director of Agriculture of the Southern Circle, *i.e.*, the country south of Kyaukse, has under his charge an area of about 90,000 square miles, and on account of the slow means of communication in the country, the time he spends in trains, travelling from place to place, occupies, probably, one-third of the year. It is not possible for anyone to do full justice to his work under such conditions. The other Deputy-Director of Agriculture attends to the northern part of Burma, the Shan States and Chin Hills; he has a similar area under his charge, and as the railway to the Shan States is shortly to be opened, the importance of agricultural development there becomes obvious. There is consequently scope for a number of additional agricultural experts in Burma, but undoubtedly the most pressing need is in the dry zone, where the Government has quite recently recognised the growing importance of

**More
Agricultural
Experts
Wanted.**

cotton, by sanctioning a cotton farm at Tatkon (40 acres) and several seed farms, mainly for cotton, in the Myingyan, Pakokku, and Thayetmyo districts. The value of the Agricultural Department to the province can be gauged by a consideration of the work performed by it with regard to groundnuts; this crop was practically unknown in Burma prior to 1902, except in the Magwe district. At the time of the formation of the Agricultural Department the area under groundnuts was 15,880 acres, two years later it rose to 79,000 acres, and during the past season the figure of 199,000 acres was reached. From conversations with Government officials and farmers I gathered that the introduction of this crop means an increased income to the cultivator of Rs. 6 per acre, this resulting in a yearly additional revenue to the people of well over Rs. 1,000,000, which would probably be distributed amongst 50,000 people. That there are excellent prospects of achieving similar results as regards cotton is apparent, for at Tatkon the Department has grown on a small area Cambodia cotton, and obtained, without irrigation, a yield of 1,200lbs., whilst the average yield of cotton in Burma, according to the figures of Settlement Officers, is 70 viss at 3·65lbs., which is equal to 255½lbs.

However much I appreciate the step taken by the Government in sanctioning the cotton farm, it seems to me only a half-hearted measure, unless the Deputy-Director of Agriculture of the Southern Circle is relieved of some of his present work. I understand that some years ago the employment of a Botanist was authorised, but owing to lack of funds the post was not filled. As the agricultural expert of the Southern Circle possesses a distinct bent for plant breeding, I am convinced that another agriculturist (farming expert) would be of great value to the country; and as the finances of Burma are now more flourishing, I trust that the Government will see its way to engage one or two agricultural experts from

Europe, Egypt, or Canada. It must be borne in mind that the study of the language, the habits and customs of the people will necessitate one or two years of hard work on the part of a new man before he can undertake the work of teaching the cultivators.

The cottons of Burma are :—

Kinds of Cotton. *Wa-gale*—the name given to the annual native cotton, grown in the Dry Zone.

Wa-gyi—the cotton grown on the hill-sides of Thayetmyo, Minbu, and Prome districts.

Wa-ni—a khaki cotton, prevalent in both the above kinds.

Shan and Chin cottons—grown on the hills of the Northern and Southern Shan States and Chin Hills.

Thinbaw-wa—a tree cotton from Pernambuco, grown near Moulmein, in the Amherst district.

The total crop of cotton in Burma is almost twice as large as has been quoted in the last few years by the Government. This year was unfavourable for cotton, owing to untimely rains, but still the cotton exports will be about 75,000 bales; last year they were the same, whilst the Government in its final memorandum estimated the crop as being 47,881 bales.

Wa-gale. *Wa-gale* is the cotton grown in the Dry Zone, and constitutes the vast majority of the Burma cotton; it is made up of fibres ranging in length from $\frac{1}{2}$ to 1 inch, and longer; its colour is fairly white, and its strength is very good. Unfortunately this Burma cotton is mixed with khaki cotton, and the various pickings and immature fibres are not kept separate, which accounts for the great variety in length of fibre; the picking is also performed in the same careless way, as leaf and other impurities are present to a considerable extent. The best cotton in this mixture is called "Bhamo," and I am convinced that if this were picked separately, and without the mixing of leaves, it would command a price little below that of Middling American. Bhamo would probably be as valuable as the best Indian cottons, such as Surtee Broach, if treated properly in the picking.

Until the establishment of ginning factories in Burma, some 10 years ago, these best pickings of cotton were exported regularly to China, from which country the buyers came every year. Nothing but the best was bought by them; it was shipped to Bhamo, a river port on the Irrawaddy, and then transported by mules into China. Only a very small quantity of this cotton now finds its way into China. It has been possible, in the past, to differentiate between the good and the bad, and there is no reason why this should not be done now. The many cultivators I asked, explained the reason for the careless method of picking, by the fact that the ginning factories buy the cotton without paying attention to the length of fibre. The managers of the factories stated that they are guided in their classification merely by colour and cleanliness.

The Bhamo cotton is undoubtedly the cotton taken from bolls that are properly matured, grown on plants in good soil, and picked at the commencement of the season. I was told by several cotton buyers, that about 50 to 60 per cent. of the *Wa-gale* crop is made

up of fibres of $\frac{7}{8}$ to 1 inch in length. At every factory an army of women and children is busily engaged separating the stained and khaki cotton from the white cotton. The farmer could undertake this work when picking the cotton, but he maintains that his extra labour is not appreciated in the form of a higher price from the ginner, who is in practically all cases the buyer.

Until the commencement of this season there had been **Combine.** very keen competition between the ginning factories for the purchase of the cotton, but this year a combination of the owners of the large concerns has come into operation, and the purchase price is fixed uniformly. As the combine controls the large majority of gins (in Myingyan 260 gins are in the combine and 123 gins are outside, in Allanmyo 120 gins are in the combine and 20 gins outside) it is in a position to dictate the price to the farmers. Two ginning factories have been hired by the combine for the season, and are not worked, merely to reduce competition. The farmers complain bitterly of this combine, which is managed by three European firms of the highest reputation. At our meetings the farmers declared that the reduction in the acreage next season would be 50 per cent. Even taking the reduction at half of this, one must admit that the action of the combine will have a serious effect.

In January, 1913, when Middling American stood at 6 $\frac{3}{4}$ d. per lb. the combine ginning factories bought at Rs. 35 per 100 viss; at the time of my visit, January, 1914, Middling American was at 7.18d., and they bought at Rs. 22 per 100 viss. In other words, last year the ginner paid almost 60 per cent. more than this year, in spite of the higher price of American cotton. The highest price at which the combine bought this year was Rs. 28 per 100 viss., and the highest sale price was 5 $\frac{3}{8}$ d. per lb. in Europe. A rough calculation of the profit would be as follows:—

100 viss=360lbs., ginning outturn at 32 per cent., therefore 115.20lbs. lint cost Rs. 28=3.89d. per lb.

Calculating the cost of ginning and packing on the very liberal rate of Rs. 7-8-0 per 100 viss for ginning, and Rs. 5 per bale of 400lbs. for packing, which are much above the rates in vogue in India, and include a handsome profit on these processes, we get an additional $\frac{3}{4}$ d. for expenses. Shipping and freight to England amount to less than $\frac{1}{2}$ d. per lb. The value of the cotton seed is Rs. 21 for the quantity necessary to produce 400lbs. lint. The calculation works out, therefore as follows:—

Cost of cotton at gin	3.89d. per lb.
Ginning and baling .....	.53d. per lb.
Freight to Europe .....	.40d. per lb.
	<hr/>
	4.82d. per lb. in England.
Deduct value of seed .....	.84d.
	<hr/>
	3.98d. per lb.
	<hr/>
Selling price in Europe	5.38d. per lb.
<i>Net profit 1.40d., or 29 per cent. on outlay.</i>	



Cotton Arrivals at the Ginning Factory of Jamal's Cotton and Produce Co., Ltd., Myingyan, Burma.

The bulk of the crop was bought by the combine at Rs. 23 per 100 viss, or '694d. per lb. less than above. Some members of the combine maintain that at present they cannot sell at more than 5d., or even less, nevertheless, the profit is an extremely handsome one. Discussions with the partners of the various European concerns show that the low prices obtained were for cotton shipped to England, whilst the same type sent to the Continent not only had a readier sale, but sold at higher rates. This is quite reasonable, as the demand in Lancashire for Indian cotton is very limited.



A Screw Bale Press—many of these are still in use in Burma.

Some of the managers of the factories predicted that they would buy yet at Rs. 20 per 100 viss. When I was in the district, Middling American cotton had gone up to 7'24d., but the combine gave notice of a reduction of Rs. 1 per 100 viss, making the price Rs. 22.

Prior to the existence of the combine, the ginners paid much higher prices owing to keen competition. One of the firms confessed to making a small profit, nevertheless; but the others maintained that they made a loss. The loss, however, cannot have been very considerable.

As there is no agreement between the firms forming the combine regarding the *selling* price, it is anticipated that the combine will not have a long life. One of the immediate results is that several of the Co-operative Credit Societies are going to buy for next season's use small ginning plants, such as are used in the Central Provinces, and sell their ginned cotton in hand-pressed bales to Bombay, Cawnpore, and Calcutta cotton spinners.

The action of the combine is, I venture to say, economically unsound. In the long run the members of the combine must feel the unfavourable effects, such as a reduction of the acreage, establishment of new factories of Co-operative Societies and of Indian firms. Colloquially expressed, the system is that of "killing the goose that lays the golden egg." The combine could certainly be of great advantage in getting the farmers to keep their different pickings separate, and to keep the khaki cotton and stained cotton apart; as well as in selling to the farmers nothing but the best seed for sowing purposes, and in eliminating malpractices such as watering, or sanding.

I have discussed the whole situation with the partners of the European firms interested in the combine, and it is probable that steps will be taken to pay a premium for the Bhamo cotton. All these gentlemen showed the greatest interest in the question, and gave me the fullest information. They, of course, do not admit that their profits are as high as I estimate them to be on the basis of their own information, and they talk of "having the interest of the cultivator at heart."

Method of Purchase.

The system of purchasing cotton adopted by the ginning factories was, until the creation of the combine, that the factories, at the beginning of the season, made to their Burmese brokers huge advances, and with these the cotton was bought over extended periods. It often happened that the brokers were using these advances for manipulating the market against the firms that had given them the advances, by not delivering the cotton until they had rigged the market. The combine has stopped these long advances to the brokers, but it still makes short advances to them. The Burmese cultivator will not deal direct; and, often, he is unable to do so as his crop is mortgaged.

On the day of my visit one firm paid a broker Rs. 32,000 with which to buy cotton in the jungle; the advance is made on the basis of the purchase price fixed by the combine of, say, Rs. 23 per 100 viss. The broker has to collect the quantity corresponding to the advance, and deliver it within, say, 14 days.

I was assured by Government officials, and by the managers of ginneries, that the broker often pays the same price to the farmer, as that at which he has to deliver the cotton to the factory. His profit is made in various "unfair" ways; he buys by stone weights, such as are used throughout the jungle, and the broker sees to it that they are in his favour; or he buys, say, 80 per cent. of clean cotton and adds 20 per cent. of stained cotton, well knowing that by careful mixing the lot will pass as the admitted standard of the factory; or he will put 10lbs. of sand in every 100 viss, or he will water the cotton to that extent. The combine has been successful in stopping the

system of long advances. The firms of the combine buy, of course, at the proper weights. If an association were formed for the purpose of putting a stop to these malpractices, and of improving the staple and reputation of the Burmese cotton, its object would be most laudable.

**Local
Markets
Wanted.**

In order to ensure that the cultivator shall receive payment for the actual weight of his produce, I think the system of establishing public weigh-beams in the larger cotton villages would be a great advantage. The daily prices of similar cotton might be published by the Government at these public weighing places, which gradually, no doubt, would become markets where employes, not brokers, of the ginning factories could buy direct from the farmer, as is done extensively in Berar, Central Provinces, and Egypt. The firms of the combine would welcome such a step, as at present they are, to a great extent, in the hands of the brokers.

**Standards
of Gineries.**

Roughly speaking the ginning factories make up four standard classes, according to the absence of brown cotton, dirt, brightness of colour.

- | | | |
|---------------------------------|---|---|
| (1) Best..... | { | Bought at the same price; at the time of my visit, Rs. 23. |
| (2) Average class | | 70 per cent. of the crop is made up of these two classes. |
| (3) Severely stained | { | 25 per cent. of the crop, reduction of price Rs. 3. |
| (4) Last picking and sweepings. | | 5 per cent. of the crop, value Rs. 8 to 11 below Class (1). |

Only in rare cases are the various classes kept separate by the farmers or brokers.

Bhamo cotton is understood by the trade to be hand-ginned; if it has been machine-ginned, it must be so stated.

The firms of the combine maintain that the cultivator makes a fair profit at Rs. 20, as 10 years ago the prices he obtained were Rs. 14 and 15. From the various interviews I had with cultivators it is evident, however, that unless they can get Rs. 25 per acre they can grow other crops to better advantage.

The Burmese, notoriously a "happy-go-lucky" fellow, is not inclined to stint himself; and with him increased income means increased comforts. He has adopted with his increased income a more expensive mode of living, and his necessities have gone up enormously. The cost of all commodities has greatly increased in Burma during the past 10 years, and there has also been a general rise in the standard of living. The habit of hoarding, so prevalent in India, and to which exception is frequently taken, both from the commercial and economic point of view, is not a characteristic of the ordinary Burmese cultivator. He builds more pagodas, entertains more lavishly, and buys such articles as electric torches, American boots, &c.

**Ginning
Factories.**

The ginning factories in Burma are all modern, the oldest being erected only 10 years ago; even those owned by the Burmese and Chinese are well managed. The ginning factories of the combine have also

an excellent plant for utilising the cotton seed, groundnuts. &c. Some of the smaller factories have only hand-presses for baling. Whilst the hydraulic presses make a bale of 9 cubic feet per 400lbs., the hand-press delivers a bale of 100 viss (360lbs.) of 15 cubic feet; the latter are for shipment to Calcutta, whilst the former are sent to Europe and Japan. Only in rare cases does a ginner work on commission; his charges are very high in that case, viz. :—

Rs. 7-8 per 100 viss lint for ginning;

Rs. 5 per bale, hydraulically pressed;

Rs. 3 per bale of 365lbs., hand-pressed.



Separating the White and Khaki Cotton in a Compound of a Ginning Factory in Burma.



In the Compound of a Ginning Factory in Burma.

In every ginnery compound a large number of women and children, who receive 4 annas per day, are employed in separating the khaki and stained cotton from the white cotton.

In the height of the season some 2,000 cotton carts come daily to the largest factory, and the illustration on page 200 shows the traffic in the compound on such a day. Each cart is examined, especially as regards moisture, and the combine firms refuse to receive any cotton that has been watered. I examined several cartloads of damp cotton, which had been watered to such an extent that the cotton smelled quite musty: seeds from such lots must necessarily lose all germinating power.

General Information. Mr. J. S. Furnivall, I.C.S., who had just completed the Settlement, *i.e.*, the basis of taxation for the land in the Myingyan tract, and who in the carrying out of this work has examined a large number of cultivators, gave me the following information:—

“ Unless a cultivator receives Rs. 25 per 100 viss he has other crops which pay him better; if his yield of cotton is only 50 viss per acre he can only just pay the expense of cultivation, but as the average crop is 70 viss per acre the cultivator considers the difference of 20 viss his profit per acre, say, Rs. 5.

“ Cotton in the cotton tract is considered the most remunerative crop, and it seldom fails.

“ The rainfall is 32·63 inches.

“ The rotations are: Sesamum, cotton, millet or sesamum. Cotton, millet, fallow.

“ The cultivators manure cotton and groundnut every year; early maturing “ til ” seed (Gingelli) is sown with cotton, in order that it may have the benefit of the manure. Cotton is generally sown broadcast, but in some places it is planted in rows.

“ Where land is leased to tenants it is the custom for the land-owner to claim one-third of the produce in lieu of rent.

“ For taxation purposes the land is divided at present into four classes; on all except the best land cotton is grown. The taxation is Rs. 1-4 for the good black soil, which is class 1, the second class pays 10 annas, the third 6 annas, and the fourth 4 annas.

“ There is also a house tax of Rs. 3 per household.

“ On the good black soil cotton is not grown, because it is frequently waterlogged (no doubt Buri cotton from the Central Provinces would do well here, as it is wilt-resisting).

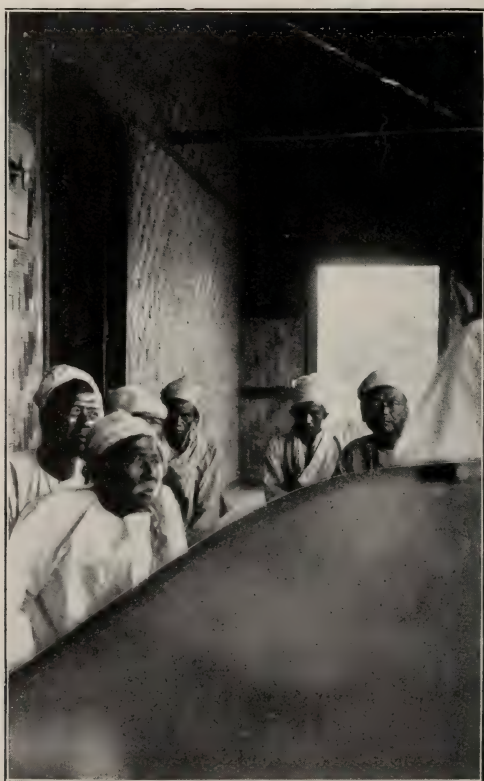
“ The average holding in the proper cotton tract is 15 to 20 acres; two-fifths or one-half is usually planted with cotton.

“ It is customary in the Myingyan district to express the value of land, rice and other produce on the basis of Rs. 25 per 100 viss cotton.”

Generally, cotton is grown on the tops of hilly lands where the good soil has frequently been washed off; some of the soil is a gravelly loam.



Some of the Burmese Cultivators who supplied me with information.



A Talk with Burmese Cultivators.

Method of Cultivation.

At the end of April, or May, the ground is harrowed four times on different days, and 7 viss of seed is sown broadcast to an acre. The harrow then passes again over the field and covers the seed. After the plants are several inches high the harrow is used again for the purpose of thinning out. The sowing takes place immediately after the first shower, and as, on arrival of the rains, every cultivator is anxious to finish sowing before the soil becomes dry, it would be impossible to sow the seed in rows, as this would take too long. Additional labour, beyond the members of the household, is very expensive; and although the cultivator recognises the gain to be obtained from row cultivation he has no funds with which to pay the wages of hired coolies. The field is generally weeded twice. The cotton crop is ready for picking about the end of September, or the beginning of October. It is the general practice to sow vegetables in the field along with the cotton for the consumption of the cultivator's own household.

There is a great variety of crops that the cultivator in the Dry Zone can grow; on his small farm of 10 to 20 acres he will often have five different crops, one of which is sure to come up satisfactorily; he grows cotton, sesamum, jowar, groundnuts, and, where low-lying land is available, always some paddy. The latter he must have for food, but of the others he gives preference to cotton, as



Levelling the Land.

it seldom fails. In a good season as much as 250 viss of cotton per acre may be picked from the best cotton soil, but the average would not come over 150 viss on first-class land, and on second-class land 100 viss may be considered an average crop in a good season. Owing to the plague and untimely rains this year's crop is about one-third less, and had it not been for the increased acreage Burma's outturn would have been considerably below that of last year.

**Wa-ni
Cotton.**

Wa-ni means red, or khaki, cotton. It is to be found in almost every field, and one of the first duties of the agricultural expert will be to separate this seed from the *Wa-gale* and *Wa-gyi*, white varieties. The cultivators maintain that a seed from this khaki cotton may produce white cotton in the following year; if so, it is clear that the red and white hybridize, and that, with care, two years' work would effectually eliminate the red. The Deputy-Director does not anticipate great difficulty in producing the original pure strains. If he succeeds in this he will have rendered a great service to the cultivators, as the ginners pay, at present, a large amount in wages for separating this khaki cotton.

The ginning outturn of the *Wa-gale* and *Wa-ni* cotton is, on the average over the year, 32 per cent., though the first and last give a higher rate. The last picking contains many seeds, the inside of which has been eaten by insects, and the weight of these seeds is therefore light; the first picking has more fibre than the second. Boll-worm evidently does a lot of damage to the cotton in Burma, and as the Burmese have a strong religious objection to destroying anything that has life, an ordinance insisting on the pulling up of cotton stalks at the end of the season to prevent the young worms from feeding in winter would be the only remedy, and might not be objected to on religious grounds. Most of the khaki cotton is used locally, and the balance is shipped, principally to Germany.

**Shan
Cotton.**

Shan States Cotton.—This cotton is about 1 inch in length, fairly glossy, but not as strong as the *Wa-gale*. The advantage of this cotton lies in its uniformity of length. The ginning factories pay Rs. 5 premium per 100 viss over the first quality of *Wa-gale*, and I was told that it is in good demand.

The cultivation is carried out by the "Taungya" system. The cultivators burn the jungle on a slope of a hill, or mountain, in January or February. In July they harrow the ground, sow one basket of cotton seed, and a quarter basket of sesamum seed, to the acre. Sesamum seed is very minute. After sowing, the seed is covered by harrowing. In September the sesamum is cut off and the cotton is allowed to develop. Three weedings are given altogether. When the rains are good, sesamum will probably be washed out, but the cotton gets the advantage of the water; if on the other hand the rains are not heavy the sesamum turns out better than the cotton. It is a well-known saying that when sesamum does well cotton suffers.

I was unable to obtain the exact yield per acre, but no doubt cotton is a paying crop in the Shan States, and we shall probably see a considerable extension after the approaching completion of the railway, if the Department of Agriculture is enabled, by increased staff, to give practical demonstrations of the value of selected seed.

The cultivators grow cotton on the same plot from one to four years, but generally for not more than three years; when the soil has become too impoverished they proceed to another spot and repeat the Taungya system. The cotton is at times allowed to remain more than one year in the soil, but the cultivators are recognising that the

second and third year's growths produce inferior lint and much smaller yields.

Cotton is said to be grown throughout the Shan States, but owing to transport difficulties the quantity that enters commercial channels is unimportant. Most of it is used by the tribes themselves, who are said to be clever at spinning and weaving on their primitive hand machines. In this connection I may say that in the villages of the Dry Zone which I visited, the sound of the hand loom is heard everywhere; in some cases hand spinning is also carried on, but of late years the weavers have found it to their advantage to use factory spun yarn. The loom is very primitive, the shuttle is thrown through the warp by hand, the introduction of a shuttle-race, of a letting-off and taking-in motion ought to mean a great saving of time at very little extra cost. Hand-weaving in Burma will not die out very quickly, and the improvement of the hand-loom might well receive the attention of the Co-operative Credit Societies, which are becoming so strong a factor in Burma.

**Wa-gyi
Cotton.**

Wa-gyi, meaning late cotton, is grown in the districts of Thayetmyo, Prome, and Minbu. This cotton may be called Lower Burma cotton, in contra-distinction to *Wa-gale*, which is cultivated in the Dry Zone of Upper Burma. These two cottons have, more or less, the same length, $\frac{5}{8}$ to 1 inch, but the colour of *Wa-gyi* is a clear, or dead, white, and the bolls seem to open more freely than those of *Wa-gale*, which accounts for the cleaner appearance. The percentage of *Wa-ni*, the khaki cotton that is present in the Burmese cottons, is less in *Wa-gyi* than in *Wa-gale*. The ginning outturn of *Wa-gyi* is 38 to 39 per cent., against 32 to 33 per cent. of *Wa-gale* and Shan cotton.

Wa-gyi is cultivated in exactly the same way as Shan cotton, *i.e.*, on the Taungya system. At the time of my visit, in January, I saw many hill-sides being cleared of jungle by burning, in preparation



A Field of *Wa-gyi* Cotton.

(Notice the Bamboos and other shrubs growing in the field.)

for cotton. It is the custom to let the cotton plant stand two years, but this is disappearing, owing to inferior yield and quality. The sesamum, which is grown mixed with cotton, yields on the best land about 36 gallons of seed to the acre. Of cotton, 100 viss may be considered an average crop, but 250 viss have been picked under best conditions. A fair price for sesamum is Rs. 4 per basket; for cotton Rs. 32 per 100 viss has been considered in the past a low price. The illustration shows the primitive method in which the fields are cultivated; the soil is almost entirely gravel, of a reddish appearance.

The wages for picking are 2 annas per head for a morning's work of 3 hours, from 6 to 9 a.m., and 2 annas for the same number of hours in the afternoon.

It is at 9 o'clock that the Burmese monks make their morning tour through the villages to receive the gifts of rice from the inhabitants. For some period of his life every Burman enters the monkhood—a state most highly esteemed. Gifts to the monks are viewed as reflecting honour upon the givers; and should the monks in their morning or evening pilgrimages refrain from passing along certain streets, the omission is regarded by the villagers as a punishment.

Until a few years ago agents from China used to buy up and export the whole of the seed cotton of Lower Burma, but now the crop is bought by the modern ginning factories which have been established. During the last few years, the cultivators I interviewed received from the ginning factories Rs. 38 to Rs. 40 per 100 viss, but as these factories are owned by the same firms as those at Myingyan, the combine will also be effective in Lower Burma, and the price will no doubt be lowered.

The method of buying is the same as described under Wa-gale cotton, *i.e.*, through brokers who receive advances from the factories.

One ginning factory manager at Allahmyo told me that the average prices and crops during the last few years were as follows:—

	1910.	1911.	1912.	1913.
Rs.	43 ..	51 ..	38 ..	34 per 100 viss.
Size of crop	220,000 ..	250,000 ..	280,000 ..	350,000 viss.

The average rainfall during the last three years was:—

1911.	1912.	1913.
37 inches. ..	45 inches. ..	39 inches.

Cotton from second year's plants is called "Wa-ponzo," its ginning outturn is 35 per cent. against 38 to 39 per cent. of the annual cotton. One-tenth of the cotton crop in Lower Burma comes from the second year's growth.

It is owing to the higher ginning outturn (difference of 6 per cent.) and to the cleaner picking that Wa-gyi commands a higher price than Wa-gale. The different pickings are not kept separate.

At the time of my visit the first pickings came into the ginning factories; picking generally goes on until May.

Thinaw-wa Cotton. *Thinaw-wa*, a perennial tree cotton of the Brazilian type, is commercially grown by the a Karen Planting and Trading Company, Ltd., near Moulmein. Owing to the difficulties of communication I was prevented from visiting the estate, where about 1,000 acres are stated to be

under cotton, mostly tree cottons, but experiments are also being made with Egyptian, American, and Australian cottons. I was informed that owing to labour troubles the progress made has not been very satisfactory.

The Agricultural Department has a small farm of 10 acres at Pwinbyu, in the Mon Canal area of the Minbu district, where Cambodia and Wa-gyi are being grown on small plots. Next season experiments with several Egyptian varieties will be undertaken. Irrigation for 60,000 acres is available in this district, but sugar-cane may enter into competition with cotton in this tract.

A Cambodia experiment at Tatkon, in the Yamethin district, yielded this year at the rate of 1,200lbs. seed-cotton to the acre, ginning outturn 35 per cent.

The Burmese is generally described as an indolent and improvident man. This may be true of the Burman in the south, or in Lower Burma, but the Government officials of Upper Burma whom I consulted expressed themselves as unanimously opposed to this description. They said that he is hard-working and very intelligent. In confirmation of this statement, and as showing to what a comparatively small extent he is in the hands of moneylenders, I may state that only about 20 per cent. of the cotton crop is sold in bazaars in repayment of loans. For this, of course, a fair price is not received. The fact that Co-operative Credit Societies are increasing rapidly, especially in Upper Burma, is a healthy sign.

In conclusion, I must express my appreciation of the excellent arrangements made by Mr. H. Clayton, I.C.S., Director of Agriculture for Burma, who mapped out my itinerary, and by convening cultivators at all villages and towns which we visited, enabled me to obtain a great deal of first-hand information. The managers of the



Carrying Burmese Cotton Bales on board the Irrawaddy Steamers.

ginning factories also kindly assisted me with a great deal of information, and the Rangoon firms showed the greatest interest in my tour, and in my verbal report of it.

In the course of my tour through Burma I also discussed the cotton question with the Lieutenant-Governor, the Hon. Sir Harvey Adamson, K.C.S.I., the Revenue Secretary, The Hon. Mr. W. J. Keith, I.C.S., and with the Commissioners and Deputy-Commissioners of the cotton tract.

I have every hope that with an increased staff on the Agricultural Department, with the goodwill of owners and managers of the ginning factories, with improved means of communication, by road and rail, to the Shan States, Burma will continue to increase its output of cotton.

The problem of improving the quality of cotton in Burma, by seed selection and a separation of the pickings, does not seem to be too difficult to solve.

Part IV.

INDUSTRIAL INDIA, with special reference to the Cotton Industry.

As was mentioned in the chapter dealing with the history of cotton, India occupied the pre-eminent position in cotton manufacture up to the Middle Ages. She was also renowned for the skill of her artisans in other directions. In design and colour blending these workers seemed to be richly endowed by nature.

In architecture, wood carving, metal work, and earthenware, the Indian artisan had attained a state of perfection. To a large extent India remains untouched by the industrial revolution that began in Europe, and owing to the low cost of labour the use of machinery, even to-day, is not extensive. The factory system as it developed in Europe during the last century is difficult to introduce into hot climates; indeed, people who have been brought up as agricultural labourers, seem to regard factory life with misgiving. It is for this reason that in India only the low caste workers will take to the factories, and even these return periodically to their native villages to assist in the harvest, or in the preparation of the land that is owned by the family.

The climatic conditions of India, and the inclinations of the people towards agriculture, seem to me to make their employment in factories an unnatural one.

The greater part of the industrial development of India has come about through foreign capital and foreign enterprise. Politicians complain of the large amounts which are sent out of the country in the shape of interest and dividends, and often, almost in the same breath, they clamour for more capital from abroad; they do not take into consideration the financial risks that have attended the introduction of foreign industrial enterprises. They want money for railways, but object to the mining of gold, the raising of oil, and the growing of tea and cotton. They wish the minerals to remain under the ground, and the fertility of the soil not to be reduced by the cultivation of crops that are mainly for export, until such time as Indian capital will be found to work the industries. Indian capital is characterised as shy, and it will continue so, as long as the principle is maintained of whole families directing business concerns, regardless of the ability of the individual members. The recent native bank crisis was an indication of the inability of the average Indian to control large commercial concerns. The Swadeshi movement, which, a few years ago, was flourishing in all parts of India, has died a natural death owing to the same causes. The interest of the business must

be placed before that of the family. Generally speaking, the Hindu and the Mohammedan of the best type, keep out of commerce and industry, for the possession of money does not, as a rule, appeal to them. Thus it comes about that the type of Indian usually found at the head of commercial and industrial enterprises is not always the best from the business standpoint. The Cotton spinning and weaving industry of Bombay and Ahmedabad forms a notable exception to this rule. Another reason for the slow development of the factory system in India is that in consequence of the secluded life of Indian women (except in Burma), changes of fashion, to which to a great extent we in Europe owe the development of our industries, does not make itself felt there. Referring to the seclusion of women in India, Sir J. Bampfylde Fuller, K.C.S.I., C.I.E., says, in his most able book, "The Empire of India": "According to the theory of Orientals, of whatever creed, the function of women is limited to those processes that are concerned directly or indirectly with the reproduction of the species; she is concerned with her husband and with the bearing and rearing of children, and no occasion is afforded her for the exercise of faculties which are not connected more or less closely with these ends. She exercises no enviroinal, as opposed to reproductive, activities. She is concerned with the race, not with herself."

What are the immediate wants of the vast majority of the nation, *i.e.*, of the country people, in the way of manufactured articles? A few yards of cotton cloth, sandals, a few vessels, either of earthenware or metal; furniture, consisting of a low bedstead made of rough wood, and plaited coir, and a few boxes. All these articles used to be made in the village, and, in some remote districts, are still produced by local labour.

In my opinion, Indian manufacture should be co-ordinated with agriculture; the ginning of cotton, the pressing of oil seed, the milling of rice, and the making of agricultural implements are industries allied to agriculture to which India should devote herself with all energy; but the further working-up of raw materials, unless anything but the crudest product is required, should with advantage to India be left to the West.

COTTON SPINNING AND WEAVING BY HAND.

Cotton spinning by hand is rapidly dying out; it is only carried on in some remote villages; on my journey I saw hand spinning in a few villages of Burma, Madras, and the North-western Frontier Province. The yarn produced by the hand wheel is very uneven, coarse, and very much dearer than machine-spun yarn. The yarn spun by the cotton mills in India is principally coarse, 8^s. to 12^s. for use in the hand loom. Hand weaving is, next to agriculture, the industry which employs most people in India. It is maintained by many that this industry is fast making room for the power loom, but I am inclined to think that, as regards coarse goods, the hand loom has no rival. In the Indian Trade Journal (Aug. 21, 1913) the average yearly production of hand-loom cloth was stated to be 278,742,484lbs. from 1910/1912, whilst 248,418,423lbs. was given as the average for the years 1896/99.



Photo by Bremner & Co., Lahore.

A woman of Cashmere spinning cotton yarn.



Weaving in the North-west Frontier Province.

(The weaver is seated in a hole dug in the ground and works the shafts with his feet.)

It must be remembered that the cost of the native loom is trifling. An Indian authority says that the capital of a weaver's business is made up as follows :—

	Rs.
Cost of loom	2 8 0
Warping sticks	0 2 0
Winding wheel	0 2 0
Yarn for two pieces	5 0 0
Shop	4 0 0
	<hr/>
	Rs. 11 12 0
	= 15s. 8d.

It must be remembered that the weaver is not solely occupied on his loom. He attends to the household duties, to field duties, and in many cases the owner of a loom weaves only, as it were, to fill up leisure hours, just as so much knitting is done in Europe. There is no excise duty payable on cloth produced by hand looms, whilst cloth produced by power looms pays $3\frac{1}{2}$ per cent. on the value. The Indian power looms contribute yearly slightly over £3 per loom, according to production, to the excise.



Warping for Native Looms at Ahmedabad.

On an Indian hand loom, 20 picks per minute are the average, the weaver throws the shuttle by hand through the warp, which necessitates, of course, a slow movement, as he has to release, with every pick, his grip of the reed. The introduction of a shuttle thrower, such as is in use on English hand looms, would not occasion an outlay of two shillings per loom, and would almost double the production. The looms

have no let-off and take-in motion. I feel confident that the hand-loom weaver, with the slight improvement suggested, would be able to withstand for some time the competition of the power loom. There is no doubt that hand-loom cloth, although coarser, is more durable and



Warping in the North-west Frontier Province.



Sizing the warps.

much more suited to agriculturists than finer machine-woven cloth. The hand loom gives employment to the women of India who, on account of religious or social customs, are unable to work in factories; and as the weaving is done frequently on the verandah, or quite outside the house, the work is done in a healthier atmosphere than is found in a factory.

The advantage of leaving the loom, and going to work in the fields, or in the house, is not to be undervalued. Co-operative Credit Societies will be of great usefulness to this industry, especially in the disposal of the goods produced, in the purchase of yarn and the making of improved looms.

Indian hand looms at present supply about one-third of the consumption of cloth in India ; and without much trouble the capacity of the hand loom could be easily doubled, provided a very small additional outlay were made in the improvement of the mechanism. The hand-loom weaver in Europe can easily attain a speed of 50 picks a minute. The hand loom in India has undoubtedly a future for coarse goods, as well as for very fine intricate designs for which the Jacquard machine is, perhaps, too complicated.

INDIAN COTTON INDUSTRY.

The first cotton spinning mill in India was built in 1817 on the banks of the Hooghly, near Calcutta, and it was called the "Bowreah Mill." It passed through several unsuccessful years, but beyond that fact there seems to be no record of it. The present Bowreah Mills are managed by the well-known and highly successful firm, Kettlewell, Bullen, & Co. In 1851 a cotton mill was established at Broach, and in 1854 the first cotton spinning mill in Bombay was erected. Since then progress in mill building has been rapid, as may be seen from the statement issued by the Bombay Millowners' Association.

From that statement we learn that whilst the number of spindles has increased only by $1\frac{1}{2}$ millions during the last 12 years, the power looms have increased in the same period from 41,180 to 94,136. Almost the whole of the capital invested in the Indian cotton industry, amounting to about £14,000,000, has been raised in India. A few mills are managed and largely owned by Europeans, but the majority of mills are limited companies controlled by Indian and Parsee gentlemen, who are frequently connected with several mills. These controlling agents are usually paid on the quantity of yarn and cloth produced, regardless of profit, counts, reed, and pick. Latterly, however, a few firms have introduced the system of payment on the profits of the company.

The machinery used in Indian cotton mills is exclusively of English make, spinning machinery being mostly supplied by Platt Bros., Ltd., Asa Lees & Co., Ltd., Howard & Bullough, Ltd. ; looms by the Blackburn Loom and Weaving Machinery Making Co., Ltd., Henry Livesey, Ltd., and others ; bobbins and shuttles are mostly those of the Wilson Bros. Bobbin Company, Ltd. Some of the mills are sprinklered, the installations being made by Mather & Platt, Ltd.

Spindles and Looms.**PROGRESS OF INDIAN MILLS DURING THE PAST 38 YEARS.**

Year ending 30th June.	Number of Mills.	Number of Spindles.	Number of Looms.	Average Number of Hands employed daily.	Approximate Quantity of Cotton consumed.	
					Cwts.	Bales of 392lbs.
1876	47	1,100,112	9,139	?	?	?
1877	51	1,244,206	10,385	?	?	?
1878	53	1,289,706	10,533	?	?	?
1879	56	1,452,794	13,018	42,914	936,547	267,585
1880	56	1,461,590	13,502	44,410	1,076,708	307,631
1881	57	1,513,096	13,707	46,430	1,326,461	378,989
1882	65	1,620,814	14,172	48,467	1,391,467	397,562
1883	67	1,790,388	15,373	53,476	1,597,946	456,556
1884	79	2,001,667	16,262	60,387	1,859,777	531,365
1885	87	2,145,646	16,537	67,186	2,088,621	596,749
1886	95	2,261,561	17,455	74,383	2,251,214	643,204
1887	103	2,421,290	18,536	76,942	2,541,966	726,276
1888	114	2,488,851	19,496	82,379	2,754,437	786,982
1889	124	2,762,518	21,561	91,598	3,110,289	888,654
1890	137	3,274,196	23,412	102,721	3,529,617	1,008,462
1891	134	3,351,694	24,531	111,018	4,126,171	1,178,906
1892	139	3,402,232	25,444	116,161	4,080,783	1,165,938
1893	141	3,575,917	28,164	121,500	4,098,528	1,171,008
1894	142	3,649,736	31,154	130,461	4,278,778	1,222,508
1895	148	3,809,929	35,338	138,669	4,695,999	1,341,714
1896	155	3,932,946	37,270	145,432	4,932,613	1,409,318
1897	173	4,065,618	37,584	144,335	4,553,276	1,300,936
1898	185	4,259,720	38,013	148,964	5,184,648	1,481,328
1899	188	4,728,333	39,069	162,108	5,863,165	1,675,190
1900	193	4,945,783	40,124	161,189	5,086,732	1,453,352
1901	193	5,006,936	41,180	172,883	4,731,090	1,351,740
1902	192	5,006,965	42,584	181,031	6,177,633	1,765,038
1903	192	5,043,297	44,092	184,399	6,087,690	1,739,430
1904	191	5,118,121	45,337	184,779	6,106,681	1,744,766
1905	197	5,163,486	50,139	195,277	6,577,354	1,879,244
1906	217	5,279,595	52,668	208,616	7,082,306	2,023,516
1907	224	5,333,275	58,436	205,696	6,930,595	1,980,170
1908	241	5,756,020	67,920	221,195	6,970,250	1,991,500
1909	259	6,053,231	76,898	236,924	7,381,500	2,109,000
1910	263	6,195,671	82,725	233,624	6,772,535	1,935,000
1911	263	6,357,460	85,352	230,649	6,670,531	1,905,366
1912	268	6,463,929	88,951	243,637	7,175,357	2,050,102
1913	272	6,596,862	94,136	253,786	7,336,056	2,096,016

There are 186 cotton mills in Bombay Presidency, representing 4,610,317 spindles, and 73,473 looms, and employing 173,411 operatives. Bombay and Ahmedabad are the great cotton manufacturing towns; the remaining mills are distributed as follows over the country:

	Number of Mills.	Number of Spindles.	Number of Looms.	Average Number of Hands Employed Daily.
Rajputana	3	35,616	1,119	2,385
Berar	3	45,852	956	2,478
Central Provinces	7	216,256	3,826	12,403
Hyderabad (Nizam's Territory) ..	3	59,246	820	3,049
Central India	4	68,995	1,474	3,104
Bengal Presidency	15	380,367	2,293	10,106
Punjab (a)	11	146,180	1,224	2,799
United Pr. of Agra & Oudh (b) ..	18	458,568	4,762	14,757
Madras Presidency	14	439,506	2,337	22,161
Travancore	1	25,560	—	672
Mysore	2	39,944	223	1,407
Pondicherry	5	70,455	1,629	5,054

(a) Including one in course of erection. (b) Including one in course of erection.

The imports of yarn from the United Kingdom and other countries are equal to about 7 per cent. of the total production in British India. The imports are:—

	Nos. 1 ^s to 25 ^s .	Above No. 25 ^s .	Total Imports.
	lbs.	lbs.	lbs.
Average 1896-97 to 1900-01	5,654,194	38,315,540	43,969,734
Average, 1901-02 to 1905-06 ..	3,571,768	29,095,637	32,667,405
Average, 1906-07 to 1910-11 ..	2,608,278	31,574,481	34,182,759
1911-12	1,549,448	35,452,712	37,002,160
1912-13	4,147,598	40,163,550	44,311,148

Production. The total production of yarn in the mills in British India, as officially reported, and the exports, are as follows:—

	Nos. 1 ^s to 25 ^s .	Above No. 25 ^s .	Total Production.	Total Exports.
	lbs.	lbs.	lbs.	lbs.
Average, 1896-97 to 1900-01	423,906,898	20,082,852	443,989,750	198,002,463
Average, 1901-02 to 1905-6	537,379,018	39,935,969	577,314,987	270,818,888
Average, 1906-07 to 1910-11	555,373,854	53,552,521	608,926,375	228,318,890
1911-12	531,662,851	59,178,816	590,841,667	161,129,123
1912-13	589,076,152	61,489,014	650,565,166	214,879,789

The production of woven goods in the mills in British India, as reported, has been as follows:—

—	Grey.	Other kinds.	Total.
	lbs.	lbs.	lbs.
Average, 1896-97 to 1900-01	80,557,484	11,295,465	91,852,949
Average, 1901-02 to 1905-06	109,884,271	25,009,554	134,893,825
Average, 1906-07 to 1910-11	154,123,927	40,007,307	194,131,234
1911-12	192,977,167	59,149,040	252,126,207
1912-13	196,126,873	71,532,912	267,659,785

The Indian mills use, almost exclusively, cotton grown in India. The average consumption of Egyptian cotton is not much above 1,000 bales. Whilst American cotton is increasing in favour, still 10,000 to 20,000 bales may be looked upon as an average figure for the last few years. It is true that during the year ending 1912, about 100,000 bales of American cotton were imported, but this was due to the fact that the better classes of Indian cotton had unduly advanced in price.

The cost of transport of American cotton to up-country India, via Europe, is calculated as .46d. per lb. This includes the charge for re-pressing, insurance rates being very high for cotton so carelessly packed as American.

More than one-half of the Indian cotton crop is brought to the Bombay market, and that is the reason why Bombay is not only the centre of the raw cotton trade, but also of the cotton industry. I am not aware that any spinning firms own cotton plantations, but some of them have their own ginning factories, adjoining the mills. This is the case up-country. Spinners as a rule do not hold stocks of cotton, but buy their raw material as it is required.

Counts. It is well known that Indian cotton is of short staple, and is usually dirty, owing to careless picking; therefore it is suitable only for low counts. The proportion of yarns of counts higher than 25's (25×840 yards = 1lb.) in 1911 and 1912 was slightly over 10 per cent. of the total production. Ten years prior to that this percentage was only five. There is therefore a slight tendency to spin higher counts, but I do not think Indian cotton mills will largely enter into competition with Lancashire cotton mills, as in the production of finer counts skilled and reliable workmen are a necessity.

The export of Indian yarn is principally to China. The Straits Settlements and Ceylon are large customers for cloth made in India.

Owing to the unsettled state of the Chinese market during the last few years, Indian cotton spinning mills have suffered severely; in fact, had it not been for the unprecedented demands of the home market, the effect on the Indian cotton mills would have been very serious.

Exports. The exports of Indian yarn and cloth during the last 10 years were as follows :—

FIGURES IN THOUSANDS OF POUNDS STERLING, 000 BEING OMITTED.

—	1902-03	1903-04.	1904-05.	1905-06.	1906-07.
Twist and yarn ...	5,693	5,894	6,544	8,258	6,931
Manufactures	978	1,087	1,218	1,359	1,181
—	1907-08.	1908-09.	1909-10.	1910-11.	1911-12.
Twist and yarn	5,982	6,454	6,473	5,749	5,060
Manufactures	1,196	1,238	1,471	1,592	1,459

The weaving of cloth by machine is largely concentrated in the Bombay district, 89 per cent. of the total output of woven goods being made there. Seventy-five per cent. of the whole production of the Indian cotton mills consists of grey goods.

Cotton yarns are bought almost entirely in the United Kingdom. Holland and Switzerland exported to India during 1911/12, £75,000 and £74,000 worth respectively, and Japan £51,000. The importation from the latter country is worth mentioning, as in previous years practically no yarn had been imported from Japan.

Imports. A third of the total import trade consists of cotton piece goods. During the last decade the figures are as follows :—

FIGURES IN THOUSANDS OF POUNDS STERLING, 000 BEING OMITTED.

—	1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
Twist and yarn	1,532	1,428	1,658	2,284	2,149
Manufactures	18,766	19,246	23,706	26,012	25,130
—	1907-08.	1908-09.	1909-10.	1910-11.	1911-12.
Twist and yarn.....	2,462	2,433	2,213	2,092	2,527
Manufactures	29,566	22,911	24,034	27,802	30,520

In considering these figures, the increased value of raw material must be taken into consideration. Fifty per cent., roughly, constitutes grey goods. The United Kingdom supplied in 1911/12, 92 per cent. of the total, and this is probably the greatest material reward which Great Britain receives from the possession of India. Among other countries, Japan has made a marked advance, sending hosiery, principally, of a total value of £453,000. It may be said that practically the whole of the imports of hosiery come from Japan.

Coal. Coal used to be imported, until recently, from England for the purpose of working the cotton mills, but during the last two decades Indian coal is being utilised. Bengal coal, which is sent by rail from Calcutta, and thence per steamer to Bombay, costs about 16s. per ton. Owing to

the increased sea freight, and the scarcity of railway wagons, Japanese coal has entered into competition with Bengal coal. In 1900 Indian cotton mills are calculated to have used about 700,000 tons of coal. A few mills are worked by electricity, and a station for the supply of electric current is at present being erected, and it is anticipated that a large number of cotton mills in Bombay will make use of this new power. A few mills are driven by Diesel oil-engines, for which the oil supply comes from Burma.

The mill buildings are generally of the Lancashire type.

**Earning
Capacity.**

It is difficult to obtain any reliable data as to the dividends paid by Indian cotton mills, though they have certainly fallen very much during the last five years.

An average of 3 per cent. for spinning mills and 9 per cent. for weaving mills may be taken as approximately correct, and this cannot be looked upon as a satisfactory return on capital invested in an industry in India.

Labour.

As regards labour, the Indian millowners are severely handicapped. The mill operatives really belong to the agricultural class, and although one may find in Bombay and Ahmedabad—the principal centres of the textile industry—men who have given up agricultural work, by far the large majority are field labourers. It is the aim of most of them to possess a small piece of land in their native district. One result is that the mill operative



A "Smoke Room" in an Indian Cotton Mill.

absents himself frequently, and in most cases without leave. He will be away from the mill for several months together, and indeed looks upon factory employment more as a makeshift. It is often the case that the operatives are too lazy to come to work, and in

some places men are specially kept whose duty it is to "drum" the workpeople together. It is a striking picture when visiting a mill to see in the mill yard large numbers of operatives loitering about, crouching down, and chewing, drinking, washing, or even sleeping. Indeed, in every mill compound, open spaces which are called smoke-rooms are set apart, where the operatives take their frequent rests. One of the mill-owners decided that these smoke-rooms should be locked until half an hour after the engine started and half an hour before closing of the mills, as he argued that during those times there was no need to smoke, but the operatives struck work and remained out three days.

There is an incessant string of operatives going in and out of the mill. The climatic conditions do not permit of anything like continuous work in the mill; it is, however, not so much overstrain as laziness which is responsible for this loitering of the operatives. Intermittent work has become so prevalent that millowners now frequently pay a premium to those who have worked all the week or the month without absenting themselves for a day from the mill. It has become imperative for the employer to engage about 25 per cent. more people than he requires, every day. I have been shown the list of attendances of the operatives of a mill, and the average number of absentees during October and November was, 212 and 240 out of a total of 890 workpeople necessary for a spinning mill of 23,424 spindles. In some of the departments 67 out of 183 did not attend on certain days, with the result that at times the card or spinning room had to be stopped owing to the unexpected absence of the workpeople.

At all the mills there is a number of casual workers who never work more than half time. The Indian millworker does not seem to possess either energy or ambition; he is content to continue the kind of work at which he started his mill life. I have been assured that increased incomes lead the coolies to dissipation and vice. Women are usually only employed in the reeling rooms, but in a few cases I have seen them at work at a ring frame. The millworkers are very independent, and apt to take offence easily. The fact that there is such a scarcity of trained operatives confirms them in this attitude and places the employer at the mercy of the operatives' vagaries. These people require a very small amount of money for their necessities, a few coppers a day will provide food for a family; their clothing is reduced to an absolute minimum, and their furniture consists of a few boxes and a low wooden bed frame covered with coir netting. I have been in a room where three families lived together; the room was 12 feet by 12 feet, and not higher than 10 feet. It is said that the mill hands spend more money on liquor than on food and clothing. Only a very small percentage of the workpeople can read, and even in Bombay only 25 per cent. of the children attend primary schools.

Workers are searched before leaving the mill, and I have been told that it is not rare for brass fittings to disappear from the mill in an inexplicable manner. The moral tone of the workers generally leaves much to be desired.

The wages of the operatives are, in most cases, paid monthly, and it is the practice of the millowner to keep one month's wages in

hand. The operatives come to the mills only from necessity, and have no money when they begin work; they are therefore forced to apply to a money-lender for means to keep them for two months. As the money-lenders make very high charges, the operatives hardly ever get out of their clutches.

So far as labour is concerned the millowners are largely in the hands of the gangmen who engage the workers. The gangmen must be consulted when additional men are wanted, and they obtain a commission from each man engaged. These gangmen simply act as intermediaries, and do little work themselves.

Capability of Indian Textile Operative. According to figures published in 1907 a comparison* between the capabilities of the Indian and the Lancashire mill operative is as follows:—

	England.	India.†
Number of operatives per 1,000 spindles ..	4.2	28
Yearly output of yarn of one operative....	7,736 lbs.	4,000 lbs.
Yearly yarn output of one spindle	32 lbs.	112 lbs.
Number of workpeople per 1,000 looms ..	430	1250
Weekly cloth output per loom in yards ..	767 yds.	240 yds.
“ “ “ “ “ in lbs.....	181 lbs.	64 lbs.

It will of course be understood that the smaller proportion of ring spindles in England and the finer counts spun in England are responsible for the comparatively smaller yearly output of yarn per spindle, and that at the time when the compilation was made the working hours in India were much longer than they are at present. If an English operative produces 7,736lbs. against 4,000lbs. by an Indian, the length of yarn is probably four times greater, as is shown by the yearly yarn output per spindle; in the weaving the difference is similar. This difference in the output per operative minimises any advantage that the Indian millowner may have over his European confrère in the shape of lower wages. Moreover, the Indian millowner has to renew his plant oftener, his mill stores do not last half as long as in Lancashire, and for the purpose of producing his coarse counts he is obliged to erect a much greater number of carding machines to feed a given number of spindles than is the case in England, where the production of fine yarns is the rule. The expenditure on machinery is therefore correspondingly high, and packing and freight must be added to the cost in England. In a weaving shed I visited, containing

* It must be borne in mind that in India the proportion of ring to mule spindles is 4 to 1, whilst in England it is 1 to 4. Many more operatives are required for ring spindles than for mule spindles, whilst the output of the ring spindle is generally estimated to be half as much again as that of the mule spindle when spinning the same count. The figures do not state whether they include the operatives of the reeling department or not. A comparison is therefore difficult.

† Mr. N. N. Wadia, of Bombay, the member for India on the Committee of the International Cotton Federation, informed me that the following figures would apply to Indian mills in 1911:—

Number of operatives per 1,000 spindles ...	...	...	28 to 30
Yearly output of yarn per one operative ...	...	...	3,500 to 4,000 lbs.
Yearly yarn output of one spindle ...	...	...	100 to 112 lbs.
Number of workpeople per 1,000 looms ...	...	...	880
Weekly cloth output per loom in yards ...	...	...	234 yds.
“ “ “ “ “ lbs. ...	...	...	50 lbs.

3,000 looms, only six operatives were able to attend to three looms each. The rest of the operatives had two looms each. Although the cotton mills may be owned and managed by Indians, yet in almost every mill of importance we find Lancashire men of experience directing the technical business of the various departments. Latterly technical education in India is making advance, and positions as tacklers are being taken by Indians.

Indian The Act of 1881 stipulated that children below seven
Factory Acts. years of age should not be employed in mills, and that those of 7-12 years should only work as half-timers for nine hours. It also introduced factory inspection, and prescribed a certain amount of fencing of machinery.

In 1891 the age limit of half-timers was increased to 9 and 14 years, and their working hours reduced to seven; no employment to be undertaken before 5 a.m. or after 8 p.m.: this limitation also applied to women, who were, however, allowed to work 11 hours. All mills had to stop four days in every month. If an Indian festival takes place on a week-day the factory generally works the following Sunday.

Owing to the installation of electric light in the mills, some millowners, endeavouring to gain advantage over others, worked 14 and even 15 hours, and this caused new legislation to be introduced. In 1912, the Indian Factory Act of 1911 came into operation; this fixes the maximum hours in a mill as 12 for men, 11 for women, and 6 for half-timers. A certificate as to the physical fitness and the age of half-timers must be produced. Work must not begin before 6-30 a.m. and must cease by 7 p.m. Regulations for ventilating, lighting, supply of drinking water, fire escapes, fencing of machinery were introduced. Four rest days per month were maintained. Infants are allowed to accompany their mothers to the mill.

The Factory Act is strictly enforced in Bombay, Ahmedabad, Calcutta, and Cawnpore, but I am told that in other parts of India it is practically a dead letter. The number of Factory Inspectors is being increased, but is evidently not yet sufficient. With regard to the age limit of children a great many breaches of the law are committed. One mill manager told me that he knew of half-timers working in the morning at one mill, and in the afternoon at another.

It is often maintained in India, and on the Continent of Europe, that the Indian factory legislation was initiated by the millowners of Lancashire. I am in a position to contradict this statement emphatically. Factory legislation was introduced owing to the activity of the Lancashire Textile Workers' Association, and the recent curtailment of the working hours was brought about by some of the more advanced millowners in India, who recognised that the efficiency of the mill operative is increased by shorter hours, and that the industry would suffer less from over-production. This reduction in the working hours should be borne in mind when considering the recent increase spindles and looms.

Jute Mills. Jute was formerly used as clothing in India by the poorest; nowadays, only on rare occasions does one meet a man clad in sackcloth. India, principally Bengal, may be said to have a monopoly of the growth of this fibre, and it is, therefore, not astonishing to find that Europeans have built mills round Calcutta. The jute industry has, through the increased demand for its products, made great headway during the last few years, and a number of new mills have been established. It may be said that, contrary to the case in the cotton industry, the jute industry is entirely in the hands of Europeans. The raw material is principally exported to Scotland and Germany. Owing to India's position in the supply of this fibre, cotton manufacturers often argue that it would be wise to raise the amount at present obtained from the excise duty on cotton cloth manufactured on power looms in India, by imposing an export duty on jute. This would necessitate the imposition of an excise duty on jute cloth manufactured in India, unless the Calcutta millowners were to have a "preference" over their Dundee confrères. The Calcutta mills turn out yearly about £12,000,000 worth of jute cloth (gunny) and bags. The jute industry comes next in importance to the cotton industry.

"The Indian Trade Journal," an interesting periodical of the Commercial Intelligence Department, published recently the following article on the jute mills in India:—

"The record of the jute industry may well be said to be one of uninterrupted progress. The following statement shows quinquennial averages from the earliest year for which complete information is available with actuals for the last four years; and the figures in brackets represent the variations for each period, taking the average of the quinquennium from 1879-80 to 1883-84 as 100. It will be seen that the number of looms and spindles in operation has increased to a very much larger extent than either the number of mills at work or the amount of nominal capital employed:—

	Number of mills at work.	Nominal Capital (in lakhs of Rs.).	Number (in thousands) of		
			Persons employed.	Looms.	Spindles.
1879-80 to 1883-84	21 (100)	270.7 (100)	38.8 (100)	5.5 (100)	88 (100)
1884-85 to 1888-89	24 (114)	341.6 (126)	52.7 (136)	7 (127)	138.4 (157)
1889-90 to 1893-94	26 (124)	402.6 (149)	64.3 (166)	8.3 (151)	172.6 (196)
1894-95 to 1898-99	31 (148)	522.1 (193)	86.7 (223)	11.7 (213)	244.8 (278)
1899-1900 to 1903-04	36 (171)	680 (251)	114.2 (294)	16.2 (295)	334.6 (380)
1904-05 to 1908-09	46 (219)	960 (355)	165 (425)	24.8 (451)	510.5 (580)
1909-10	60 (286)	1,151 (425)	204.1 (526)	31.4 (571)	645.9 (734)
1910-11	58 (276)	1,150 (425)	216.4 (558)	33.1 (602)	682.5 (776)
1911-12	59 (281)	1,193 (441)	201.3 (519)	32.9 (598)	677.5 (770)
1912-13	61 (290)	1,196.5 (442)	204 (525)	34 (618)	708.7 (805)

The production of the mills has increased to a still greater extent. The following figures show the exports of jute manufactures and the declared values for the quinquennial periods. The combined value of gunny bags and gunny cloth exported by sea in 1912-13 is over 18 times as great as the average value of the exports in the period 1879-80 to 1883-84 :—

EXPORTS.

	Jute Manufactures.		Value in lakhs of Rs.
	Gunny bags in millions.	Gunny cloths in millions of yards.	
1879-80 to 1883-84..	54·9 (100)	4·4 (100)	124·9 (100)
1884-85 to 1888-89..	77 (140)	15·4 (350)	162·9 (130)
1889-90 to 1893-94..	111·5 (203)	41 (992)	289·3 (232)
1894-95 to 1898-99..	171·2 (312)	182 (4,136)	518 (415)
1899-1900 to 1903-04	206·5 (376)	427·2 (9,709)	826·5 (662)
1904-05 to 1908-09..	257·8 (469)	698 (15,864)	1,442·7 (1,154)
1909-10	364·4 (664)	940·1 (21,366)	1,709·6 (1,369)
1910-11	360·9 (657)	955·3 (21,711)	1,699·4 (1,361)
1911-12	289·9 (528)	871·5 (19,807)	1,600·8 (1,282)
1912-13	311·7 (568)	1,021·8 (23,223)	2,287·1 (1,831)

Up to the last quinquennium the exports of raw jute were marked by increases from year to year though the improvement was not so rapid as in the case of manufactures. A slight decrease in the exports occurred in 1909-10 as compared with the figures for the preceding quinquennial period and a further decline in 1910-11, but a marked recovery was made in 1911-12, which was accentuated in 1912-13 :—

EXPORTS.

	Jute, raw, in millions of cwt.
1879-80 to 1883-84	7·5 (100)
1884-85 to 1888-89	8·9 (119)
1889-90 to 1893-94	10 (133)
1894-95 to 1898-99	12·3 (164)
1899-1900 to 1903-04	12·7 (169)
1904-05 to 1908-09	15·09 (201)
1909-10	14·6 (195)
1910-11	12·7 (169)
1911-12	16·2 (216)
1912-13	17·5 (233)

The price of raw jute reached its highest point in 1906-07, the rate being Rs. 65 per bale ; in 1907-08 it dropped to Rs. 42 per bale, and the fall was accentuated in 1908-09 and 1909-10, the price having declined to 36·4 and Rs. 31 per bale respectively. In 1910-11 the price rose again to Rs. 41-8-0, to Rs. 51-4-0 in 1911-12, and further to Rs. 54-12-0 in 1912-13. The following are the quinquennial average prices

per bale (400 pounds) of ordinary jute calculated from the prices current published by the Bengal Chamber of Commerce :—

	Price of jute, ordinary, per bale of 400 lbs.			
	Rs.	a.	p.	
1879-80 to 1883-84	23	8	0	(100)
1884-85 to 1888-89	23	3	2	(99)
1889-90 to 1893-94	32	6	5	(138)
1894-95 to 1898-99	30	12	0	(131)
1899-1900 to 1903-04	32	1	7	(137)
1904-05 to 1908-09	44	13	6	(191)
1909-10	31	0	0	(132)
1910-11	41	8	0	(177)
1911-12	51	4	0	(218)
1912-13	54	12	0	(233)

The average prices of gunny cloth have been as follows :—

	Price of Hessian cloth 10½ oz. 40" per 100 yds.			
	Rs.	a.	p.	
1879-80 to 1883-84	10	7	11	(100)
1884-85 to 1888-89	8	0	7	(77)
1889-90 to 1893-94	10	6	6	(99)
1894-95 to 1898-99	9	11	8	(93)
1899-1900 to 1903-04	10	2	10	(97)
1904-05 to 1908-09	11	14	1	(112)
1909-10	9	3	6	(88)
1910-11	9	5	6	(89)
1911-12	11	14	0	(113)
1912-13	16	6	0	(156)

Woollen Mills. There are only four woollen mills in the Punjab and the United Provinces. As the winter months are exceedingly cold in the north of India, the industry might flourish had it at its disposal softer home-grown wool. The wool of the Indian sheep is generally very coarse, and the woollen mills have to import their better raw material from Australia.

Hand weaving is also carried on, especially in the north, but owing to the defects of the Indian wool, only the coarse blankets and carpets are much known. Whilst formerly carpets of considerable value were frequently produced, the present tendency is to meet the European demand for showy goods. The jails in Northern India have taken up carpet weaving as an industry, and a few Americans have also started carpet weaving.

A word on the world-famous Cashmere shawl may not be out of place. The Cashmere shawl is made of goat's hair, and only the soft portion of the hair of the Tibet goat is supposed to be used. This species of goat not being sufficiently numerous to satisfy the demand, the substitution of the hair of other goats has caused a general falling-off in the quality of the shawls. Nowadays, the only exportation of "Cashmere" shawls is that made by tourists, who frequently take away with them "Cashmere" shawls made in Saxony.

Metal Industries.

There are a few iron and brass foundries in the country, but with the exception of the Tata Iron and Steel Works and the workshops of the railways and the Public Works Department, they are of minor importance. The Tata Iron and Steel Works deserve special mention. This company was floated in 1907 with a capital of £1,250,000, subscribed in India. The town of Sakchi in the Singhbhum district of Bihar and Orissa has come into being since its inception. The company owns 20 square miles of iron ore land, and is under the supervision of a cosmopolitan staff of engineers. Blast furnaces and steel-rolling mills have been erected. The new town has about 15,000 inhabitants. Two thousand Indians and 160 Europeans are employed at the steel-works, and an output of 90,000 tons per year is anticipated.

The hammering of metal into all kinds of vessels is an industry which employs a great many people in small workshops. The brass and copper sheets are imported, and elaborate designs are worked on plates, vases, urns, &c., many having artistic and pleasing shapes. Of late aluminium has come into use in and around the large cities. It is noteworthy that Mohammedans generally use tinned copper, but Hindoos prefer brass.

Glass Making.

Glass is being manufactured in a primitive way in many parts of India, the principal products being bangles. Religious prejudice seems to bar the use of glass vessels for drinking and eating. There is said to be a difficulty in blowing glass in hot climates.

Pottery.

Mooltan is famous for its pottery, and in the Sind Desert vases of graceful shape with brightly coloured designs, mostly blue and white, but of a somewhat rough glaze, are made. The Indian tiles used in the building of mosques and temples have in many cases lasted for centuries. Each village has its own potter, who makes the water vessels for the poor.

Dyeing.

At Ahmedabad, and at several other places, block printing and dyeing have developed into a big industry. The work is carried on by hand in the open air. Whilst formerly pure vegetable dyes were used, one can now see the men mixing their ingredients out of packets of aniline and alizarine dyes. Dyeing and printing are ancient Indian arts, and recently Europe seems to be again importing from India large quantities of block printed calicoes of decided Oriental designs.

Cotton Ginning Factories.

Of the remaining factories, the cotton ginning and pressing mills are the most important. Figures for the native states are not obtainable, but British India possessed in 1911 1,166 factories, employing 89,751 workpeople. In 1903 only 610 factories were in existence, but at that time 248 establishments were ginning cotton by hand. The number of hand ginning factories has now been reduced to two. The ginning factories are almost exclusively fitted with Platt's roller gins. Only in the South of Bombay Presidency, in Hubli and district, are saw

gins being used for separating the fibre from the seed. Spinners maintain that the latter process leads to the cutting of the fibres, although the fans used clear the cotton of impurities.

Many of the important ginning factories possess also cotton bale presses.

Cotton Bale Presses. The bale presses in use are mostly worked hydraulically; there are about 1,200 in the country. The weight of the bale is 392lbs. nett, with the exception of the South Madras bale, which weighs 500lbs. The density of Indian bales exceeds those of all other countries.

The following particulars may be of interest :—

Indian cotton bales (400lbs.) :

49 inches by 20 inches by 17 inches measurement.
42·738lbs. density per cubic foot.
9·64 cubic feet per bale.
8lbs. actual weight of canvas and iron hoops.

Egyptian cotton bales (740lbs.) :

52 inches by 21½ inches by 32 inches measurement.
35·8lbs. density per cubic foot.
20·7 cubic feet per bale.
25lbs. weight of canvas and iron hoops.

American cotton bales (524lbs.) :

58 inches by 30 inches by 22 inches measurement.
23·65lbs. density per cubic foot.
21·15 cubic feet per bale.
29lbs. weight of canvas and hoops.

African cotton bales (400lbs.) :

40½ inches by 27 inches by 27 inches measurement.
23·41lbs. density per cubic foot.
17·08lbs. cubic feet per bale.
10lbs. weight of canvas and hoops.

The Indian bales are undoubtedly the best packed of any cotton bales.

As the presses work only during the cotton season, they do not give permanent employment to the people.

There are about 115 presses in India handling jute.

Oil Mills. Oil mills are mostly of the primitive kind; they are to be met with in all parts of the country. There are very few modern oil factories, those in Burmah being probably the most up to date in the Indian Empire. Until a few years ago practically all the cotton seed that was not required for planting purposes was given as fodder to the cattle, but since 1907 large and increasing quantities are yearly exported. In 1911-1912, 4,073,110 cwts. of cotton seed were exported. As a bullock gets four to five pounds of seed daily, the loss of fodder

caused through these exports is very serious. An extension of the oil seed mills is much needed in India, as not only does the seed husk and the kernel represent fodder, but also manure. The following table shows the quantity and value of the principal oil seeds exported from India in 1901-02 and 1911-12 :—

EXPORTS.

	1901-02.		1911-12.	
	Quantity.	Value.	Quantity.	Value.
	Cwts.	£	Cwts.	£
Linseed	7,327,869	4,509,196	10,440,462	8,643,277
Rape	6,924,895	2,970,403	4,709,539	2,341,384
Groundnuts	1,085,415	524,948	3,822,583	2,120,484
Sesamum	2,447,149	1,429,291	1,896,391	1,350,861
Castor	1,323,896	572,612	2,403,872	1,178,462
Cotton.....	2,036,056	309,210	4,073,110	1,012,752
Poppy	934,080	521,156	698,867	497,455

Railways. By far the greater part of the Indian railway system is owned, though not, in all cases, worked, by the Government.

In the case of the few lines not already acquired, Government has the right of purchase at certain dates. The progress made in the construction of new lines is seen from the accompanying table :—

	Mileage open for Traffic at end of Year.		
	1901.	1911.	1912.*
Broad gauge (5ft. 6in.)	14,057	17,050	17,206
Metre gauge (3ft. 3½in.).....	10,506	13,760	14,193
Special gauges (2ft. 6in. and 2ft.)..	810	2,029	2,094
Total	25,373	32,839	33,493

* Provisional figures.

At the end of 1911, 42,113 miles, including double lines and sidings, were constructed. Madras Presidency seems to be more in need of railway extension than any other province.

Travelling in India is exceedingly comfortable on the main lines. In the first-class carriages more space is provided than in the carriages of any other country, and such luxuries as baths and douches are supplied. The restaurant cars are likewise comfortable. Travelling on branch lines is, however, distinctly disagreeable, owing to inferior carriages and long waits at stations.

MINERAL PRODUCTIONS.

The following table shows the approximate returns of production :—

	Quantities.					Value.	
	1901.	1904.	1907.	1910.	1911.	1901.	1911.
Coal (tons)	6,635,727	8,216,436	11,147,339	12,047,413	12,715,534	£ 1,323,372	£ 2,502,616
Gold (ounces)	532,303	618,746	557,387	573,120	583,567	1,931,030	2,238,143
Petroleum (thousands of galls.)	50,075	118,491	152,046	214,830	225,792	204,342	884,398
Manganese ore (tons)	157,736	150,190	902,291	800,907	670,290	215,934	648,701
Salt (tons).....	1,102,039	1,105,051	1,102,785	1,485,613	1,225,490	374,133	429,295
Saltpetre (tons)	15,555	15,480	14,404	15,886	14,674	191,904	220,012
Mica *(cwt.s.)	16,298	19,575	38,922	42,593	48,871	70,034	207,778
Lead ore (tons).....	—	—	—	31,211	35,361	—	181,989
Tungsten ore (tons)	—	—	—	395	1,308	—	99,989
Rubies, sapphires, and spinels (carats)	229,127	265,901	334,535	262,019	288,213	105,936	67,594
Iron ore (tons)	49,798	71,685	68,729	54,626	366,180	7,932	54,487
Jadestone* (cwt.s.)	3,015	4,130	4,001	6,165	2,028	31,713	29,815
Tin ore (cwt.s.)	1,394	1,414	1,584	1,776	1,946	7,773	9,388
Silver†	—	—	—	—	—	—	11,575
Graphite (tons)	2,785	3,323	2,433	3,992	4,048	15,248	9,425

* Figures represent exports in official years.

† From silver-lead ore.

APPENDIX.

Statistical Tables, showing Cotton Area, Yield and Export in the different Provinces during the last ten years, published by the Indian Government.

Rules for the Guidance of the Members of Co-operative Seed Unions in the Central Provinces.

Note on American Cotton in Sind, by G. S. Henderson, Deputy-Director of Agriculture, Sind.

How can the Cultivator improve his Cotton Crop ?
(Article by David Milne, Economic Botanist, Lyallpur).

Cotton in Gwalior State and Indore State.

Glossary.

Books of Reference.

Area and Yield of Cotton in each Province. Table issued by the Department of Statistics, India.
Area (acres).

PROVINCE.	1904-05	1905-06	1906-07	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14
BOMBAY (including Native States) (a)	5,955,000	6,665,000	7,383,000	7,101,000	6,241,000	6,469,000	7,334,000	5,786,000	6,826,000	7,100,000
CENTRAL PROVINCES AND BEHAR	4,553,000	4,849,000	4,678,000	4,176,000	4,176,000	4,107,000	4,487,000	4,648,000	4,493,000	4,715,000
HYDERABAD STATE	2,731,000	2,537,000	3,480,000	3,100,000	2,902,000	3,401,000	3,562,000	3,294,000	2,888,000	3,653,000
MADRAS (b)	1,755,000	1,597,000	1,703,000	1,855,000	1,576,000	1,569,000	1,873,000	2,414,000	2,414,000	2,593,000
PUNJAB (including Native States)	1,698,000	2,020,000	1,413,000	1,474,000	1,562,000	1,436,000	1,385,000	1,582,000	1,575,000	2,053,000
UNITED PROVINCES (c)	1,201,000	1,372,000	1,489,000	1,461,000	1,392,000	1,241,000	1,347,000	1,358,000	1,318,000	1,426,000
CENTRAL INDIA STATES	846,000	979,000	1,132,000	993,000	978,000	1,068,000	1,349,000	1,400,000	1,314,000	1,586,000
RAJPUTANA STATES	459,000	291,000	428,000	438,000	389,000	464,000	465,000	263,000	393,000	470,000
SIND (including Native States)	221,000	283,000	250,000	259,000	259,000	214,000	279,000	346,000	296,000	332,000
HYDERABAD STATE	189,000	183,000	187,000	195,000	204,000	198,000	167,000	186,000	233,000	288,000
MYMOUR	71,000	76,000	89,000	84,000	65,000	81,000	101,000	101,000	154,000	93,000
BIHAR AND ORISSA	(d)	(d)	(d)	(d)	(d)	(d)	(d)	88,000	92,000	86,000
NORTH-WEST FRONTIER PROVINCE (e)	49,000	59,000	61,000	48,000	34,000	32,000	33,000	56,000	56,000	59,000
BENGAL (f)	128,000	132,000	151,000	149,000	161,000	166,000	169,000	63,000	51,000	51,000
ALMER-MERWARA	52,000	29,000	40,000	41,000	40,000	39,000	45,000	27,000	50,000	57,000
ASSAM	(d)	(d)	(d)	(d)	(d)	(d)	(d)	36,000	35,000	33,000
TOTAL	19,918,000	21,072,000	22,454,000	21,630,000	19,998,000	20,545,000	22,596,000	21,615,000	22,025,000	24,595,000

Yield (bales of 400lbs. each).

PROVINCE.	1904-05	1905-06	1906-07	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14
BOMBAY (including Native States) (a)	796,000	1,198,000	1,762,000	1,039,000	1,282,000	1,061,000	1,450,000	685,000	1,520,000	1,572,000
CENTRAL PROVINCES AND BEHAR	1,229,000	818,000	881,000	585,000	765,000	1,070,000	629,000	913,000	910,000	961,000
HYDERABAD STATE	330,000	303,000	449,000	293,000	307,000	461,000	293,000	300,000	300,000	400,000
MADRAS (b)	132,000	145,000	157,000	198,000	162,000	180,000	235,000	335,000	471,000	513,000
PUNJAB (including Native States)	408,000	192,000	357,000	356,000	324,000	396,000	303,000	373,000	373,000	594,000
UNITED PROVINCES (c)	368,000	394,000	639,000	268,000	426,000	384,000	348,000	241,000	228,000	484,000
CENTRAL INDIA STATES	136,000	130,000	222,000	55,000	144,000	221,000	237,000	228,000	206,000	273,000
RAJPUTANA STATES	186,000	61,000	201,000	91,000	80,000	148,000	143,000	73,000	125,000	132,000
SIND (including Native States)	97,000	84,000	155,000	135,000	101,000	104,000	97,000	124,000	123,000	133,000
HYDERABAD STATE	39,000	35,000	36,000	29,000	41,000	32,000	28,000	32,000	46,000	50,000
MYMOUR	5,000	5,000	10,000	6,000	3,000	6,000	10,000	17,000	19,000	16,000
BIHAR AND ORISSA	(d)	(d)	(d)	(d)	(d)	(d)	(d)	19,000	19,000	19,000
NORTH-WEST FRONTIER PROVINCE (e)	10,000	13,000	13,000	9,000	12,000	7,000	8,000	12,000	13,000	14,000
BENGAL (f)	37,000	33,000	33,000	38,000	35,000	35,000	49,000	25,000	21,000	13,000
ALMER-MERWARA	18,000	5,000	19,000	10,000	9,000	13,000	20,000	11,000	26,000	15,000
ASSAM	(d)	(d)	(d)	(d)	(d)	(d)	(d)	11,000	10,000	12,000
TOTAL	3,791,000	3,416,000	4,934,000	3,122,000	3,692,000	4,718,000	3,853,000	3,288,000	4,610,000	5,201,000
NET EXPORTS AND CONSUMPTION (g)	3,943,602	4,168,451	4,854,579	3,782,401	4,200,150	4,928,000	4,303,000	4,004,000	4,563,000	5,797,000

(a) Includes the State of Baroda.

(b) The estimates for Madras down to 1906-07 relate only to *rainfed* villages; but since that year estimates for *samudrai* and *whole man* villages and Native States have also been included.

(c) Includes the Native State of Rampur.

(d) Included under Bengal.

(e) Includes the North and Eastern Provinces from 1919-20.

(f) Includes Bihar and Orissa and Assam down to 1910-11 and the Hill Tippera State from 1906-07.

(g) The exports as well as the mill consumption are for the year ending September 30th, No reliable information exists as to the annual consumption outside the mills, but in 1911 it was settled in consultation with the Bombay Cotton Trade Association to adopt the conventional estimate of 450,000 bales. This figure has been included in the figure for each year shown against this item.

STATEMENT SHOWING THE AREA, CULTIVATED AREA, ACREAGE UNDER COTTON, AND THE PERCENTAGE OF COTTON AREA IN EACH PROVINCE DURING THE YEARS 1902-03 TO 1911-12, SUPPLIED BY THE AGRICULTURAL ADVISER TO THE GOVERNMENT OF INDIA.

No.	Year.	Total Area.	Cultivated Area.	Area under Cotton.	Percentage of Cotton Area to	
					Total Area.	Cultivated Area.
BOMBAY, INCLUDING SIND.						
1	1902-03 ..	73,786,683	26,938,499	3,048,196	4.1	11.3
2	1903-04 ..	73,844,981	27,302,923	3,779,088	5.1	13.8
3	1904-05 ..	74,118,924	26,547,469	3,605,985	4.9	13.6
4	1905-06 ..	71,320,199	25,843,833	3,979,676	5.6	15.4
5	1906-07 ..	74,820,503	28,222,981	4,170,750	5.6	14.8
6	1907-08 ..	78,681,697	28,059,216	4,138,176	5.3	14.7
7	1908-09 ..	78,544,808	29,167,812	3,549,580	4.5	12.2
8	1909-10 ..	78,694,222	29,168,429	4,082,785	5.2	14.0
9	1910-11 ..	78,870,676	29,463,727	4,660,006	5.9	15.8
10	1911-12 ..	78,886,729	25,847,065	4,443,018	5.6	17.2
CENTRAL PROVINCES AND BERAR.						
1	1902-03 ..	59,039,399	22,977,212	3,892,030	6.8	16.9
2	1903-04 ..	59,186,889	23,505,808	4,144,847	7.0	17.6
3	1904-05 ..	59,199,235	23,843,639	4,545,967	7.7	19.0
4	1905-06 ..	59,808,030	24,336,353	4,849,567	8.1	19.9
5	1906-07 ..	64,511,101	24,712,565	4,683,598	7.3	19.0
6	1907-08 ..	64,601,454	23,471,049	4,432,206	6.9	18.9
7	1908-09 ..	64,601,251	24,017,178	4,176,332	6.4	17.4
8	1909-10 ..	64,232,485	24,886,230	4,167,540	6.5	16.7
9	1910-11 ..	64,330,315	24,928,362	4,487,185	7.0	18.0
10	1911-12 ..	64,317,541	25,026,300	4,648,203	7.2	18.6
MADRAS.						
1	1902-03 ..	64,651,796	26,893,738	1,580,867	2.4	5.9
2	1903-04 ..	64,710,056	26,973,974	1,769,911	2.7	6.6
3	1904-05 ..	66,441,505	25,525,978	2,007,297	3.2	7.9
4	1905-06 ..	66,907,301	26,411,306	1,896,305	2.8	7.2
5	1906-07 ..	67,471,633	27,556,342	1,833,744	2.7	6.6
6	1907-08 ..	87,155,387	33,802,679	2,189,582	2.5	6.5
7	1908-09 ..	89,571,650	33,755,304	1,989,015	2.2	5.9
8	1909-10 ..	89,015,611	32,217,294	2,028,538	2.3	6.3
9	1910-11 ..	88,713,200	33,754,796	2,323,257	2.6	6.9
10	1911-12 ..	89,072,612	33,068,409	2,675,838	3.0	8.0
UNITED PROVINCES.						
1	1902-03 ..	66,608,042	35,397,590	1,239,208	1.9	3.5
2	1903-04 ..	66,541,410	35,711,023	835,738	1.3	2.3
3	1904-05 ..	66,322,151	35,935,391	1,190,298	1.8	3.3
4	1905-06 ..	66,301,596	34,994,635	1,362,438	2.0	3.9
5	1906-07 ..	68,704,040	36,666,179	1,462,742	2.1	4.0
6	1907-08 ..	68,869,634	33,104,452	1,430,347	2.0	4.3
7	1908-09 ..	68,826,104	35,888,646	1,376,982	2.0	3.8
8	1909-10 ..	68,841,165	36,594,600	1,223,896	1.8	3.4
9	1910-11 ..	68,272,714	36,250,036	1,332,961	1.9	3.7
10	1911-12 ..	68,275,839	35,590,711	901,181	1.3	2.5

STATEMENT SHOWING THE AREA, CULTIVATED AREA, ACREAGE UNDER COTTON, AND THE PERCENTAGE OF COTTON AREA IN EACH PROVINCE DURING THE YEARS 1902-03 TO 1911-12.—*continued.*

No.	Year.	Total Area.	Cultivated Area.	Area under Cotton.	Percentage of Cotton Area to	
					Total Area.	Cultivated Area.
PUNJAB.						
1	1902-03 ..	57,324,137	22,705,117	1,041,661	1·8	4·6
2	1903-04 ..	57,132,701	24,911,540	1,047,532	1·8	4·2
3	1904-05 ..	57,180,019	23,217,955	1,301,614	2·3	5·6
4	1905-06 ..	57,188,064	24,112,119	685,841	1·2	2·8
5	1906-07 ..	57,266,113	25,960,499	1,260,510	2·2	4·9
6	1907-08 ..	61,189,858	21,801,075	1,317,850	2·1	6·0
7	1908-09 ..	61,189,988	25,821,102	1,447,734	2·4	5·6
8	1909-10 ..	61,262,639	25,593,401	1,227,025	2·0	4·8
9	1910-11 ..	61,223,743	24,808,111	1,249,777	2·0	5·0
10	1911-12 ..	61,255,052	22,257,053	1,462,500	2·4	6·6
BENGAL.						
1	1902-03 ..	100,192,331	51,361,727	100,719	·1	·2
2	1903-04 ..	100,277,749	50,135,808	92,001	·09	·2
3	1904-05 ..	100,410,013	52,668,188	87,680	·08	·2
4	1905-06 ..	99,847,126	52,231,746	73,600	·07	·1
5	1906-07 ..	99,250,645	51,006,433	76,200	·08	·1
6	1907-08 ..	100,630,922	49,988,300	99,000	·1	·2
7	1908-09 ..	103,029,801	47,310,248	97,300	·1	·2
8	1909-10 ..	102,987,949	52,049,840	99,084	·1	·2
9	1910-11 ..	102,819,420	52,070,778	98,299	·1	·2
10	1911-12 ..	102,819,420	52,487,400	123,200	·1	·2
ASSAM.						
1	1902-03 ..	18,802,973	5,073,396	3,492	·02	·07
2	1903-04 ..	18,492,149	4,947,237	3,997	·02	·08
3	1904-05 ..	18,416,603	4,963,920	4,410	·02	·09
4	1905-06 ..	18,487,614	4,822,129	8,450	·05	·18
5	1906-07 ..	22,920,104	4,389,343	7,191	·03	·17
6	1907-08 ..	30,024,743	5,113,336	7,591	·025	·15
7	1908-09 ..	31,305,574	5,416,389	15,967	·05	·30
8	1909-10 ..	31,305,574	5,582,276	17,304	·05	·31
9	1910-11 ..	31,305,574	5,560,544	42,210	·13	·76
10	1911-12 ..	31,305,574	5,711,698	37,620	·12	·65
BURMA.						
1	1902-03 ..	101,627,616	11,400,602	141,529	·14	1·2
2	1903-04 ..	104,019,392	15,966,507	159,640	·15	1·0
3	1904-05 ..	104,012,329	12,555,048	188,405	·18	1·5
4	1905-06 ..	104,005,441	12,399,208	173,249	·17	1·4
5	1906-07 ..	114,653,248	12,575,471	178,422	·16	1·4
6	1907-08 ..	112,987,603	12,842,308	204,261	·18	1·6
7	1908-09 ..	113,004,338	13,652,676	211,331	·19	1·6
8	1909-10 ..	114,000,262	13,857,845	202,074	·18	1·5
9	1910-11 ..	108,793,095	13,309,525	171,885	·16	1·3
10	1911-12 ..	108,799,142	13,339,916	192,169	·18	1·4
NORTH-WEST FRONTIER PROVINCE.						
1	1902-03 ..	8,461,071	2,024,784	23,843	·28	1·1
2	1903-04 ..	8,498,905	2,328,015	30,729	·35	1·3
3	1904-05 ..	8,464,135	2,018,378	34,472	·43	1·7
4	1905-06 ..	8,449,849	2,197,107	41,807	·49	1·9
5	1906-07 ..	8,494,788	2,440,939	61,195	·72	2·5
6	1907-08 ..	8,493,124	2,195,614	47,892	·56	2·1
7	1908-09 ..	8,574,443	2,438,627	54,230	·63	2·2
8	1909-10 ..	8,574,346	2,396,991	32,595	·37	1·3
9	1910-11 ..	8,574,087	2,411,695	33,710	·38	1·3
10	1911-12 ..	8,574,452	2,284,540	56,373	·65	2·5

STATEMENT SHOWING THE AREA, CULTIVATED AREA, ACREAGE UNDER COTTON, AND THE PERCENTAGE OF COTTON AREA IN EACH PROVINCE DURING THE YEARS 1902-03 TO 1911-12.—*continued.*

No.	Year.	Total Area.	Cultivated Area.	Area under Cotton.	Percentage of Cotton Area to	
					Total Area.	Cultivated Area.
AJMER MERWARA.						
1	1902-03 ..	953,852	306,539	32,638	3.4	10.5
2	1903-04 ..	959,790	337,411	31,882	3.2	9.2
3	1904-05 ..	960,565	327,570	50,690	5.2	15.3
4	1905-06 ..	960,563	187,492	28,170	3.0	15.0
5	1906-07 ..	974,226	346,861	36,495	3.8	14.5
6	1907-08 ..	1,654,685	356,627	42,199	2.5	11.8
7	1908-09 ..	1,693,790	426,748	40,395	2.4	9.4
8	1909-10 ..	1,770,921	418,162	41,140	2.3	9.8
9	1910-11 ..	1,770,921	358,753	47,846	2.7	13.1
10	1911-12 ..	1,770,921	220,175	27,560	1.6	12.7
COORG.						
1	1902-03 ..	1,012,260	152,928	—	—	—
2	1903-04 ..	1,012,260	145,254	—	—	—
3	1904-05 ..	1,012,260	139,727	—	—	—
4	1905-06 ..	1,012,260	141,190	10	—	—
5	1906-07 ..	1,012,260	141,083	121	—	—
6	1907-08 ..	1,012,260	142,176	16	—	—
7	1908-09 ..	1,012,260	138,392	6	—	—
8	1909-10 ..	1,012,260	139,427	42	—	—
9	1910-11 ..	1,012,260	141,128	8	—	—
10	1911-12 ..	1,012,260	141,128	6	—	—
PURGANA MANPUR, CENTRAL INDIA.						
1	1902-03 ..	38,871	7,218	115	.3	1.6
2	1903-04 ..	38,871	7,585	232	.6	3.6
3	1904-05 ..	38,871	7,641	274	.7	3.6
4	1905-06 ..	38,871	7,623	246	.6	3.2
5	1906-07 ..	31,383	6,900	300	.9	4.3
6	1907-08 ..	31,383	6,679	149	.5	2.2
7	1908-09 ..	31,383	6,789	100	.3	1.5
8	1909-10 ..	31,383	7,052	165	.5	2.3
9	1910-11 ..	31,383	7,146	546	1.7	7.6
10	1911-12 ..	31,382	7,188	521	1.7	7.3
NATIVE STATES.						
1	1902-03 ..	46,848,198	14,756,604	456,228	.9	3.0
2	1903-04 ..	46,871,493	15,002,673	503,753	1.0	3.3
3	1904-05 ..	47,177,643	14,665,678	524,443	1.1	3.6
4	1905-06 ..	47,152,786	12,015,009	503,665	1.0	4.2
5	1906-07 ..	47,284,188	14,923,731	625,694	1.3	4.2
6	1907-08 ..	60,711,455	19,874,647	1,143,848	1.8	5.8
7	1908-09 ..	71,576,905	27,877,746	1,100,319	1.5	4.0
8	1909-10 ..	72,130,302	28,922,927	1,289,871	1.8	4.4
9	1910-11 ..	80,706,978	30,224,765	1,546,860	1.9	5.1
10	1911-12 ..	74,804,728	29,008,479	1,312,350	1.8	4.5 *
INDIA (EXCLUDING NATIVE STATES).						
1	1902-03 ..	554,889,308	205,239,350	11,104,298	2.0	5.4
2	1903-04 ..	554,715,153	208,273,095	11,895,597	2.2	5.7
3	1904-05 ..	556,576,611	207,720,904	13,017,092	2.3	6.3
4	1905-06 ..	557,236,906	207,683,741	13,099,359	2.3	6.3
5	1906-07 ..	579,577,532	214,026,319	13,771,268	2.4	6.4
6	1907-08 ..	615,332,755	210,883,511	13,909,269	2.3	6.6
7	1908-09 ..	621,385,390	218,039,911	12,958,974	2.1	6.0
8	1909-10 ..	621,728,870	222,911,547	13,172,188	2.1	5.9
9	1910-11 ..	615,777,388	223,064,601	14,447,690	2.3	6.5
10	1911-12 ..	616,120,004	215,981,683	14,568,189	2.3	6.7

*The figures for 1911-12 are averages of the previous 3 years.

India's Cotton Exports. Table compiled by the Bengal Chamber of Commerce.

Countries to which Exported.	1903-04.	1904-05.	1905-06.	1906-07.	1907-08.	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
United Kingdom	652,183	346,512	372,513	451,718	452,561	382,613	540,895	580,225	418,012	305,545
France	559,754	234,990	482,481	560,358	624,629	455,673	498,654	499,172	291,960	327,767
China, Hong-Kong	131,200	157,368	172,286	117,356	98,797	104,268	111,544	94,550	42,016	78,763
" Treaty Ports	33,457	13,846	12,400	48,714	36,109	111,788	235,770	51,940	48,097	118,007
Spain	265,485	126,690	139,312	139,312	157,283	115,238	120,011	127,815	127,815	86,950
Holland	41,490	16,688	209	21,455	42,742	23,835	25,860	19,663	8,399	21,670
Denmark	—	—	—	—	—	—	—	—	—	179
Ceylon	8,082	8,516	9,132	6,892	7,550	10,278	7,104	5,824	8,122	6,683
Germany	1,568,466	1,025,256	1,384,016	1,663,217	1,880,016	1,136,580	1,327,144	1,394,335	890,516	950,199
Straits Settlements	853	473	819	—	1	3	3,208	10	3,336	1,283
Russia	131,649	4,388	7,038	12,702	14,920	525	4,854	2,079	—	3,514
Mauritius and Dependencies	114	132	335	60	96	99	197	197	171	178
Cochin-China	28,807	2,454	7,385	12,171	10,455	20,764	13,381	22,850	1,830	—
Aden and Dependencies	127	143	120	104	104	111	141	90	184	88
Bahrein Islands	—	—	—	1,045	653	645	416	1,755	3,396	1,156
Belgium	1,089,146	667,871	1,126,544	1,101,755	1,253,898	955,863	1,074,662	1,093,855	774,463	864,304
Other Foreign Countries	11	22	32	53	2	212	2	10	3	75
America (United States)	1,288	1,942	232	3,132	3,001	8,301	41,652	30,984	17,719	22,857
Turkey in Asia	231	52	48	365	867	1,010	173	550	24	174
Turkey in Europe	6,197	4,993	—	2,797	6,209	—	—	350	—	—
Austria	705,236	456,276	615,176	618,741	622,127	379,710	693,698	685,917	471,580	396,452
Italy	1,000,899	627,281	808,218	873,619	1,060,508	850,636	936,302	1,095,779	680,271	583,698
Africa (Zanzibar)	2,792	36	779	1,184	3,157	1,555	651	700	3,072	2,241
East Africa (Portuguese)	—	—	—	—	72	2	3	425	—	1
" (German)	—	—	—	—	—	—	—	60	587	510
Egypt	297	507	1,330	2,628	652	928	3,310	736	200	28
Arabia	2,486	2,269	1,781	2,442	1,462	461	179	1,249	2,991	2,600
Greece	—	—	—	—	805	350	—	906	1,694	—
Sweden	15,575	3,624	17,686	21,860	28,269	18,412	29,186	28,544	6,490	3,274
Australia	3,749	4,175	4,737	7,382	7,382	3,396	5,485	7,425	8,769	5,331
New Zealand	32	—	—	—	80	—	—	98	—	100
Fiji Islands	—	—	—	—	—	—	—	—	72	18
Norway	—	—	588	535	192	381	367	2,397	—	175
Natal	177	15	1	127	40	96	156	1,024	860	454
Japan	1,680,475	1,950,905	2,230,968	1,728,958	2,244,641	2,223,164	3,274,562	2,852,103	3,514,651	3,591,768
Persia	672	90	72	170	111	26	15	211	201	159
Cape Colony	44	16	16	55	18	27	22	376	615	229
Philippines	71	—	—	—	2,500	—	—	—	—	—
Other British Possessions	10	13	16	11	2	4	3	—	6	2
Portugal	—	—	—	—	—	—	686	—	381	1,050
Total	7,931,075	5,657,743	7,396,535	7,400,839	8,562,024	6,798,411	8,908,042	8,686,400	7,328,523	7,737,512

Central Provinces.

RULES FOR THE GUIDANCE OF THE MEMBERS OF CO-OPERATIVE SEED UNIONS.

(1) Each Co-operative Union shall be responsible for the distribution of selected cotton seed and of improved agricultural implements in a definite circle of villages.

(2) In this Circle there shall be appointed a Central Seed Farm, which will so long as is considered necessary by the Deputy Director of Agriculture be supplied each year with selected strains of seed from the Akola Farm. Branch seed farms shall be supplied with seed produced on the Central Farm. The area under the Central and Branch Seed Farms should be large enough to produce seed for the total area under cotton in the circle of villages represented by the Union.

(3) Each member of the Union who is a cotton-grower shall be obliged to sow his whole area under cotton with the pure seed produced on the Central Farm. These areas will constitute the branch seed farms of the Union.

(4) For each Union there shall be appointed one or more "Kamdars," with the approval of the Deputy Director of Agriculture. They shall be paid by the Union, from such funds as the Union may from time to time appoint; and the Union shall be bound by the advice of the Deputy Director of Agriculture as to their selection, appointment, control, and dismissal.

(5) The fields for the Central Seed Farm shall be the property of the members, and shall be selected by the Deputy Director of Agriculture or his staff and pointed out to the Kamdar in charge, who will see that the seed is sown in due season and that alien plants are removed at the time of flowering, both from the Central and Branch Farms. The owners of the Central Seed Farm shall be bound to sell the seed produced on their farms to the Committee at a price to be fixed by the Deputy Director of Agriculture. The Kamdar will work under the supervision and control of the Deputy Director of Agriculture and his staff; his work will be regularly supervised and reported on by the District Agricultural Assistant.

(6) To prevent the intermixture of impure with pure seed in the field, the same areas will be selected every year for the Central Seed Farm; where this is not practicable, "juar" or some other crop shall be rotated with the cotton of this Central Seed Farm.

(7) Any Branch and Central Seed Farm which, in the opinion of the Deputy Director of Agriculture, is inefficiently managed, may be removed by him from the list of Branch and Central Seed Farms; and he may thereon call on the Committee to propose fresh ones for his selection.

(8) The "kapas" of the Central Branch Seed Farms shall be ginned and stored separately, and under such conditions as will prevent any chance of the seed being mixed with other types.

(9) At the time of distribution the Union shall inform each purchaser what the vitality of the seed is as previously tested and certified by the Deputy Director of Agriculture.

(10) A sample of the seed produced on one of the branch farms of each Union shall be tested at the Akola Farm, and their relative degrees of impurity and vitality shall form the subject of a report to be read at the Divisional Meeting of the Berar Associations held on the Farm. Prizes shall be offered for the purest samples sent in by Unions themselves.

(11) The price to be charged for the seed distributed shall be decided by the Committee; but the net profit charged on the sale of agricultural implements should not exceed 12 per cent.

DRAFT BY-LAWS FOR AN AGRICULTURAL UNION (WITH OR WITHOUT SHARE CAPITAL AND WITH LIMITED LIABILITY).

Name and Style.

1. The name of this Association shall be
Agricultural Union. Its offices shall be at

Purposes.

2. The purposes of the Union are as follows :—

(i.) To secure for members practical assistance in the application of the most recent improvements in agriculture.

(ii.) To provide an organised means of bringing such improvements into use by the members as promptly as possible.

(iii.) To control by means of co-operation and united effort the purchase, production, and, as far as may be, the sale of seed, implements, produce, and live stock.

(iv.) To secure by this means the economic betterment of members by keeping them in constant touch with the most profitable and prudent method of modern scientific agriculture.

Liability.

3. The liability of the Union is limited—

(i.) To its share capital, if any.

(ii.) To its reserve fund.

(iii.) To the contracts entered into by each member to pay an annual subscription to the Union funds.

Area of Control.

4. The operations of the Union for the purposes of internal control shall extend to the villages of *(here enter schedule of villages.)*

Membership.

5. Membership of the Union shall be open to any person, or to any society of persons, having cultivation within the areas of the Union's control, on the following terms :—

(i.) Promise to contribute regularly and punctually to the Union funds at such rates as may be determined by the members of the Union in general meeting.

(ii.) Promise to conform, as individuals, to such regulations for the control of purchase, production, and sale as may be adopted by the members of the Union in general meeting after approval of the Deputy Director of Agriculture. Provided that such regulations shall be framed in accordance with the co-

operative principles expressed in these by-laws, and shall, under Section 11 of the Co-operative Societies Act, be submitted to the Registrar for registration as an integral part of these by-laws.

(iii.) Promise to use every endeavour to preserve the reputation of the Union for purity and excellence of produce, and fair and honest dealing.

6. Every member of the Union must be approved, admitted, and recognised by the Union Committee, and every recognised member shall be furnished with a certificate of recognition by the Union Committee. No one shall be admitted to membership until he has paid his annual subscription in advance. **Recognised Members.**

7. As regards purchase of produce for sale as pure seed under the Union's guarantee of purity, dealings shall be confined to recognised members only. Only recognised members shall be entitled to the services of the Kamdar and to the other co-operative benefits of the Union. **Rights of Recognised Members.**

8. The affairs of the Union shall be managed by a Committee of at least members elected by the shareholders from their own members. **Management.**

9. The Committee may appoint its own secretary and other officers, salaried or otherwise, provided that the appointment of the Union's treasurer or banker shall be subject to the Registrar's approval as required by law.

10. The Deputy Director of Agriculture or any officer deputed by him shall be entitled to sit and vote at all meetings and Committee meetings of the Union.

11. The Deputy Director of Agriculture or any officer deputed by him shall at all times have access to all the books, accounts, and papers of the Union, and every member of the Union and every officer of the Union shall be bound to furnish such information respecting the affairs of the Union as the Deputy Director of Agriculture or any officer deputed by him shall require.

12. The Deputy Director of Agriculture shall have the power to summon a general meeting or Committee meeting by serving a written requisition upon the secretary of the Union and by giving 15 days' notice of his intention.

13. The affairs of the Union shall be generally supervised by the Deputy Director of Agriculture and by two honorary supervisors, who shall be members of the Union but shall not be members of the Committee. The duties of the supervisors shall not extend further than the tendering of advice to the Committee and the inspection of the Union's affairs. Honorary supervisors are intended to help the Deputy Director of Agriculture in his work of supervision, and it is their duty to act as an inspecting and reporting agency. **Supervisors.**

14. The Committee and officers of the Union shall be bound to conform to such working regulations for the practical conduct and control of the business of production, purchase, sale, distribution,

and inspection as may be framed for their guidance by the Deputy Director of Agriculture from time to time. These regulations shall be supplementary to the regulations issued to individual members, and they also shall be forwarded to the Registrar for registration according to law.

Share Capital.

15. Where a Union decides to work with share capital, a by-law concerning the amount of share capital and the number and value of the shares shall be framed and forwarded to the Registrar for approval and registration.

16. Where there is share capital no member shall receive a certificate of recognition until he has paid up the value of his shares.

17. No shareholder shall hold more than one-fifth of the shares of the Union, or shares the face value of which exceeds Rs. 1,000.

18. If there be share capital, fixed dividend at per cent. shall be a first charge on net profits. Any balance of profits shall be devoted, firstly, to the extent of one-half to the Union's reserve fund, and secondly, as regards the remainder, to return to custom.

EXAMPLE OF RETURN TO CUSTOM.

After payment of fixed dividend and allocation to reserve the Union has a balance of profits of Rs. 1,000. A has bought and sold through the Union, and has thus contributed to the Union's turnover, Rs. 500 in custom. B has, in the same way, contributed Rs. 300. C has contributed Rs. 200. The Rs. 1,000 will be returned to custom thus :—

A	5 shares	=	Rs. 500
B	3 shares	=	Rs. 300
C	2 shares	=	Rs. 200

Total 10 shares = Rs. 1,000

19. Where there is share capital, shares may be transferred by sale, gift, or mortgage to any person who is qualified for and who is admitted to membership of the Union. But no transfer of shares shall be recognised unless previous notice of the transfer has been sent to the secretary of the Union by registered letter at the registered office of the Union, and such notice has been acknowledged in writing intimating that the proposed transferee is qualified for and will be admitted to membership.

20. Shares are not withdrawable. On the death of a member the whole of his pecuniary right, title, and interest in the Union shall pass to the heir or heirs who produce a succession certificate, provided that it is open to any member to nominate a successor by written nomination delivered to the secretary. If there be more than one heir the heirs shall nominate one from amongst their number to represent them in their dealings with the Union.

21. The value of a member's interest shall be the amount paid by him for shares purchased, together with the amounts of any loans advanced to the Union by him, together with any interest due on such loans, less any sums due from him to the Union.

22. Where a Union has no share capital, all profits (resulting from balance of annual subscriptions) shall be carried to the reserve fund at the close of each year.

23. The funds of the Union shall not be employed in the business of lending money. **Restrictions on business.**

24. The Union may not, as such, borrow money from co-operative banks or societies, provided, of course, that the credit societies which are members of the Union may employ their funds in the business of the Union.

25. The Union may borrow in such manner and to such extent as the members may decide in general meeting, and borrowing powers may be delegated by the general meeting to the Union Committee.

26. The Union shall not accept deposits.

27. All funds of the Union shall be used solely in furtherance of the Union's operation in common.

28. Reserve fund of the Union shall be one and indivisible, and shall be invested in accordance with the provisions of Section 32 of Act II. of 1912 (Co-operative Societies), provided that the reserve fund may be drawn upon for an object approved by the Registrar and with his previous sanction. **Reserve Fund**

29. Every member shall be entitled to one vote. Votes by proxy shall not be admissible. **Meetings and Votes.**

30. All questions shall be decided by a majority of votes. If vote equal, the meeting vote shall be exercised by the Deputy Director of Agriculture.

31. The Union Committee shall meet at least once every two months.

32. The members of the Union shall meet in general meeting at least twice every year.

33. One-third of the members shall form a quorum for general meetings.

34. One-third of the Committee members shall form a quorum for Committee meetings.

35. A special meeting of members shall be held not later than one month after the receipt by the secretary of the Union of a written requisition signed by at least seven members.

36. The secretary shall record all proceedings of Committee and special meetings in a book to be kept for the purpose, and copies of all proceedings shall be forwarded to the Deputy Director of Agriculture.

37. Save as provided in Section 39 of the Co-operative Societies Act II. of 1912, the Union shall be wound up only with the sanction of the members assembled in a special general meeting to consider the question of liquidation, and under the orders of the Registrar of Co-operative Societies.

38. These by-laws shall not be altered or abrogated without the sanction of the Registrar of Co-operative Societies.

Short Note on American Cotton in Sind.

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Cotton is cultivated in Sind, in Hyderabad, Thar Parker, and Nawabshah districts. The area has increased considerably in the last few years. The present out-turn is about 150,000 bales per year, besides the local consumption in the villages. Before the North-western Railway was opened in Sind the amount of cotton exported from Sind was practically nil. Cotton cultivation is generally spreading north along the left bank of the Indus and east on the Eastern Nara.

It is a very profitable crop, and there is no reason why it should not be cultivated to a large extent in Upper Sind in the non-rice lands. These latter are low-lying lands having a large supply of flow water, and the excessive flooding necessary for the rice is not suitable for cotton. The comparative costs and returns of cotton and other staple crops from the Government farm at Mirpur Khas and Sukkur are given in the following statement for comparison :—

STATEMENT SHOWING COMPARATIVE COSTS AND RETURNS OF CROPS.

GROWN ON THE MIRPURKHAS FARM.

1912.	Sindhi Cotton.	American Cotton.	Egyptian Cotton.	Jowari.	Wheat.
Plot No.	E. 11	E. 10	C. 3	D. 5	B. 9
Yield in pounds	936	750	594	317	407
Value in Rupees ..	116-14-5	112-8-0	76-0-11	Kadbi 6700 49- 5-7	Chaff 889 24-10-2
Cost of Cultivation in Rupees	28- 6-4	35-2-3	31-0- 2	27- 9-0	20-10-1
Profit, Rupees	88- 8-1	77-5-9	45-0- 9	21-12-7	4- 0-1

GROWN ON THE SUKKUR FARM.

Plot No.	A. 5	A. 4	A. 1	B. 5	D. 3
Yield in pounds ..	800	456	320	Grains 620, Straw, 150 bds.	740
Value in Rupees ..	90-0-0	66-5-0	52-0-0	32-2-6	44-2-0
Cost of Cultivation in Rupees	44-0-0	31-4-0	30-8-6	19-0-6	29-1-6
Profit, Rupees	46-0-0	35-1-0	21-7-6	13-2-0	14-0-6

NOTES.—All figures are per acre.

Costs do not include Government assessment.

Plots in Sukkur Farm are still not uniform owing to presence of
" Kalar " or salt.

Sindhi cotton is a short-stapled, coarse, and strong cotton with a particularly good colour. In the market it ranks about the same as " Bengal." In the last few years the price has gone up consider-

ably, and now runs about Rs. 8-9 per maund of 81lbs.—say, $5\frac{1}{2}$ d. per pound of lint, as compared with the middling American at 7'30d., the present quotation from Liverpool. Sindhi cotton gins up to 33 per cent. The best cotton comes from Shah-jo-Bhit, near Hala.

Sindhi cotton cultivation is simple in the extreme. After irrigation, seed is broadcasted on the surface and ploughed in. Thereafter the crop receives one or two hoeings and nothing further except irrigation from time to time till picking is ready.

The improvement of Sindhi cotton could have been attempted in several ways.

(a) By producing a still coarser cotton with higher ginning out-turn. It is in this direction that some export firms wish to direct the work.

(b) By producing a finer and long-stapled cotton suitable for spinning higher counts and weaving finer materials.

The problem was to experiment and find a cotton suitable to the country, but of a much higher grade. To grade up the indigenous cotton held out but little promise in comparison to adopting a superior variety from some other part of the world. Other Indian growths of superior quality, as Broach, were soon discarded as undesirable; Egyptian was then tried, and finally American.

When the Agricultural Department was first established in Sind about eight years ago, it was thought by the Deputy Director of Agriculture, Mr. Fletcher, that Egyptian cotton would thrive in Sind. It did well on all Government farms, and it was decided to get a large area cultivated in the district. Four thousand acres were cultivated in one season by zemindars on the Jamrao Canal. Out-turn probably averaged 5 to 8 maunds per acre. The disposal of the crop was difficult, as Egyptian is not used by any of the mills in Bombay, and the produce was not sufficient to put the article on a commercial footing. The Mit-Affifi variety was of good quality, and was favourably reported on by brokers in Egypt. Auction sales were established by Government at Mirpur Khas to dispose of the produce, but the price obtained was very uneven. Up to Rs. 14 per maund of 81lbs. of seed cotton was obtained on some occasions when the presence of buyers anxious to obtain a sample caused some competition. At other sales there was little or no demand. The ginning was another difficulty; the local gins were adopted for the local cotton and did not make good work with the Egyptian. Also the local ginners were not at all anxious to handle this cotton, and buyers often found difficulties.

The disadvantages connected with Egyptian cotton in Sind are:—

(a) It needs more careful cultivation than the Sindhi. It ought to be grown in ridges.

(b) It has a long growing period. It needs to be sown at latest by beginning of April, and first picking is not generally ready till October. This entirely prevents the cultivation of Egyptian cotton on the inundation canals. In fact, it is practically only on the Jamrao Canal that it can be grown at the present time.

Still the results obtained by the efforts to introduce Egyptian cotton into Sind are very interesting and instructive. It has been proved that, given proper conditions, it will thrive well in Sind, and Sind is one of the few places outside Egypt where this class of cotton has been successful. So in the future, when the country fills up and more intensive cultivation is adopted, it is possible that Egyptian cotton may be cultivated in Sind.

Experiments with American cotton began several years ago. It was found to be promising, and among its advantages were :—

(a) Quick growing period; it can be sown in June and the first picking is available at the end of September. This early maturing characteristic is most important for Sind, as it enables the cultivator to grow American cotton on the common inundation canals.

(b) It is a good yielder, and on an average land will produce as much as Sindhi cotton per acre.

(c) It seems to be hardy, and can be cultivated in exactly a similar manner to Sindhi cotton.

(d) The marketing of the crop is much easier than is the case with Egyptian cotton.

The writer paid a visit to the chief American cotton-growing centres and selected the variety called "Triumph" as being most suitable for cultivation in Sind.

It is a big-bolled variety, it is an early and good yielder, and it is adopted for growth under irrigation.

From repeated trials on the Government farms at Mirpur Khas and Sukkur, and on sub-stations at Jacobabad, Shikarpur, Nawabshah, and Tando Mahomed Khan, it was decided to begin in the districts on a large scale. Forty tons of Triumph seed were obtained from America and these were distributed in the beginning of 1913; 10 tons in Sukkur and Upper Sind Frontier and 30 tons in the Jamrao area, respectively. The seed was distributed in good time, and members of the Department conducted village touring, interviewing all growers personally.

A considerable amount of American cotton is used in Bombay mills, so it is much to their advantage if they can buy a high grade of American cotton in India. A syndicate, chiefly consisting of Bombay millowners, was formed to buy, gin, bale, and dispose of the produce of the Triumph seed distributed by the Agricultural Department. The syndicate erected cotton gins at Mirpurkhas and Shikarpur, and the former is now in operation.

As this is the first season, it has not been possible to fix a price per maund of kapas to be paid to the growers, as the amount of expenses for ginning, baling, and freight could not be calculated exactly. The syndicate, however, has arranged to pay on delivery of the kapas at the gin one-half of the current price of middling American cotton as quoted in the *Times of India*, and the remainder of the price will be paid to the growers after the cotton and the cotton seed have been sold in Bombay or in Liverpool.

It is unfortunate that the season and inundation has been quite unsuitable for cotton in Upper Sind, and only 300 or 400 maunds of seed cotton will be obtained. However, where the cotton has had a fair chance and conditions have been observed it has been successful.

In Lower Sind most of the growers are satisfied, and the cotton is coming in satisfactorily to the gin. One large owner has indented for 300 maunds—*i.e.*, sufficient to sow 1,200 acres—for the next season.

A seed farm has been acquired by Government to prevent deterioration and mixing up of the seed.

It is too soon to say if the cotton is established on a practical basis in Lower Sind or not. But it is undoubtedly a fact that a high-grade American cotton can be grown here under ordinary Sindhi cultivation and will give a good out-turn. Economic conditions may, however, be too much for its permanent establishment.

How can the Cultivator Improve his Cotton Crop?

(An excellent article dealing with the Cotton Growing problem, by the Economic Botanist at Lyallpur. The article was published in the Punjab Vernacular Press, and is, for this reason, written in simple language.)

We have first to define what improved cottons from the zemindar's (cultivator's) point of view are. If we are to do this in a few words, we must define it, I think, as "a cotton which will leave him a greater profit per acre."

Looking a little deeper into the question, we find that several factors are involved in this.

First, it is obvious that a very important factor must be the yield of kapas per acre. A zemindar must therefore search for a variety of cotton that will grow well in his particular soil and climatic conditions, and with the sort of cultivation which he is able to give it. The plants should have many lateral branches so that they may bear many bolls; the branches should have short internodes and be stout so that they may not droop to the ground or break in the winds, and the bolls should not only be numerous but large, and should open widely in the cotton-picking season, so that the kapas may be rapidly and cleanly picked. The plants should be as resistant as possible to both insect and fungoid diseases, as only healthy plants can produce a maximum crop of bolls. Here the boll worm is our worst insect disease on cotton, and in some years very great damage is done by it. In 1911, the latest bad year of the pest, we found that it did more damage among the desi cottons than among the Narma and Dharwar cottons, and this frequently happens. Narma, I may mention, is an American cotton which has been grown longer in the North of India than the Dharwar cottons have. I think that one of the chief reasons why the boll worm often does most damage to the desi crop is that the flowering and fruiting season of desi cotton is much shorter than that of the Narma and Dharwar cottons, and therefore when the worm attacks the crop severely in the desi cotton flowering and fruiting season the desi crop may be nearly wiped out, while even if the Narma and Dharwar cottons are just as badly attacked then, they may produce something of a crop later in the season if the disease diminishes by that time. This actually happened among the cottons at Lyallpur after the bad attack of boll worm in the summer of 1911. It may be remembered that that year we had a severe storm of wind and rain in the first week of September which practically stopped the disease. In that storm most of the diseased bolls were shaken from the plants, many of the worms in these bolls were drowned in the rain water standing in pools around the plants or were caught by birds and other enemies, or met their death in other ways as they were moving from the fallen bolls. Fortunately, frosts were not early that winter, and we got a considerable crop of kapas from the late-formed bolls produced by the Dharwar and Narma cottons. As the boll worm does such a great

amount of damage in some years here, it may not be out of place for me to mention that an attack of the boll worm may be very materially checked by the simple and cheap device of nipping off and destroying the first few bolls that appear on the plants.

The comparatively few boll worms that are able to survive the winter attack the first-formed bolls on the cotton plants, and the worms from these bolls spread the disease to later-formed bolls in the field.

It is said that a single female boll-worm moth lays about 60 eggs, and that it takes about five weeks for the insect to go round the life cycle, and if we assume that half the number of eggs will give rise to female insects and half to male insects, we have 30 pairs of insects from each pair at each generation. If we start with a single pair of boll-worm insects in late June and work out, at this rate, how many insects will have originated from them by the end of October we find that the number comes to something like 60 lakhs, and if we agree that some of the eggs do not hatch out, that some worms die or are killed by enemies before they reach maturity, and on the whole estimate that only 15 pairs live to breed the next generation, we get something like a lakh and a half of insects by the end of October. By destroying the first-formed bolls, therefore, the disease may be very materially checked. Every year, whatever the season is like, my labourers go through the plots of desi cottons about the beginning of July and collect and destroy all the bolls they find on the plants whether the bolls show signs of disease or not. The American cottons are similarly treated about two weeks later than the desis, and in addition the tips of the main branches are also removed from the plants. We find that about four female labourers can perform the operation on about an acre of desi cottons in one day, and that about six female labourers can treat about an acre of American cotton in one day.

We cannot ask the labourers to examine the bolls and pick only those that show traces of the disease, as, in the first place, the labourers are not intelligent enough to distinguish affected bolls readily, and, secondly, it would require a very long time for a labourer to examine all the bolls on an acre of cotton, and so would make the cost of the work prohibitive. The collection of the first bolls may at first sight appear to reduce the crop of kapas, but our results of several years here do not show any such decrease; indeed, there is usually a decided increase in the crop got, and this is most marked in a boll-worm year. The incident of the storm in September, 1911, seems to suggest that in a bad boll-worm year the pest might be checked to some extent by shaking the plants artificially to make the affected buds and bolls fall and then flooding the land with water immediately afterwards.

Another very serious disease is the so-called "root rot." This disease does a great deal of damage to desi cottons, but it is said to cause comparatively little damage to Narma and Dharwar cottons. On lands where the disease is very bad, therefore, cultivators may find it to their advantage to grow Narma and Dharwar cottons if other conditions are suitable for these. Having grown the crop and harvested it, the farmer next brings his kapas to market and places

it before the middleman. In the Punjab that gentleman first consults his reports of the current price of rui of that quality in Karachi. The consignment is, let us say, a desi one, and he finds that rui of that quality is selling (as it is while I write) at Rs. 22-12 per maund. From this price he deducts something like the following :—

Cost of freight per maund to Karachi at, say ...	Rs. 0-15-6
Cost of ginning one maund of desi at, say	Rs. 1- 4-0
Cost of pressing one maund of desi at, say	Rs. 1- 0-0
<hr/>	
Total	Rs. 3- 3-6

The price of rui unginned here would therefore be Rs. 22-12, less Rs. 3-3-6 = Rs. 19-8-6 per maund, or Rs. 0-7-9 per seer. Assuming that one maund of rui will be contained in three maunds of kapas and that he can get Rs. 2-9 per maund for the cotton seeds, he will deduct a few annas for wastage in ginning, &c., and will estimate the value of the seeds got from the three maunds of kapas at something like Rs. 4-12.

The middleman will, in this case, have the following facts in mind: (1) That for kapas containing one-third of its weight of rui he can offer Rs. 19-8-6 plus Rs. 4-12, that is, Rs. 24-4-6 for three maunds, or Rs. 8-1-6 per maund. (2) That if the kapas contains less or more rui than one-third of its weight he can deduct from, or add to, the above price at the rate of Rs. 0-7-9 per seer. We find desi kapas giving anything between $11\frac{1}{3}$ and $15\frac{1}{3}$ seers of rui per maund, or at the market rate above quoted, differing in value from Rs. 7-2 to Rs. 9-1 per maund. Undoubtedly, then, it is a very important thing for zemindars to grow a cotton which has a high kan. We shall see that kan is by no means the only factor that the zemindars must keep in view in trying to improve his cottons, however, and, indeed, there are considerable dangers in sticking too blindly to the improvement of what is commercially termed kan. To obtain vigorous, healthy plants we require well developed seeds containing a plentiful supply of food for the baby plant, but we have frequently noticed after ginning a large number of samples of kapas that those samples that showed the highest kan contained a very large percentage of immature, of bug-sucked, and of small seeds, and were just the lots which we should not select for sowing where an improved crop is wanted. Where a large number of cotton seeds are broken by the ginning machinery and parts of them are left in the rui the kan figures also come out high. This happens especially in damp weather. Bug-sucked and immature seeds being unfortunately lighter than sound, well-developed seeds, we can quite understand that even a very small amount of fibre from each of such seeds will show a high kan. We also find that small seeds have a much larger surface in proportion to their weight than larger seeds have, and therefore if a small and a large seed were merely equally well covered with lint the small seed would show the higher kan, and again, a small seed may be worse covered than a large seed and still show as high a kan as the large one.

In attempting to raise the kan of a cotton there is thus a tendency to select smaller and smaller seeds, or unsound ones which, because of their small size or unsound food store, are unable to

produce healthy and vigorous plants. What the zemindar really wants when he asks for a cotton with an improved kan is a variety which gives a large proportion of sound, well-developed seeds, and the average individual seeds of which bear a greater amount of rui than is borne by the seeds of ordinary varieties. Unfortunately, as we have just shown, the kan figures obtained in the manner in which they are at present do not help him in this, and it is therefore absolutely essential for the zemindars, when considering the kan figures, to examine the soundness and size of the seeds in the consignment.

When we find a variety which has well-developed, healthy seeds and a higher kan we are even then not certain that it will be a more profitable variety to grow. It must not be forgotten that although a zemindar may go away quite pleased if he gets a better price per maund for his kapas than a second man, yet the second man's crop may have given so much more kapas that his total profit per acre may be much greater than that of the first person. Consequently the first man, in selecting and growing these cottons which get the highest price per maund in the market, may have really done himself considerable harm. Only recently a sample long variety of desi cotton with an exceptionally high kan was sent to me along with a letter stating that this was the desi cotton which the Agricultural Department should advise zemindars to grow. The high kan and nice appearance of the cotton had attracted the attention of the person who sent the sample, but we had eliminated that variety from the Lyallpur experiments, as, after growing it for several years, we found that it invariably gave such a poor out-turn of kapas per acre that zemindars could obtain more money per acre by growing other desi varieties. Indeed, from our experiments here and from all that I could learn about the results that zemindars got when growing it, the variety is about the worst one—from a zemindar's point of view—that I have ever met with. In order that the party who sent me the letter referred to should be able to satisfy himself on the point, however, some seeds of the variety have been sent to him, and he will doubtless be able to give us an account of his experiences with the cotton in due course.

When the rui is sent to the spinner he examines it to see how much leaf and dirt is in it. Leaf interferes with the spinning of the thread, making it uneven in thickness and weak in places. Weak, uneven thread will not pass nicely through the weaving machines. It frequently breaks them, delaying the work and increasing the expenses of making the cloth, and in the end makes a cloth that will not wear well. Also if any particles of leaf are left in the material they do not take the dye at the same rate as the rui; they give trouble in the bleaching and other processes, and a faulty-coloured cloth is the result. Leaf is extremely difficult to remove from rui, but because rui mixed with leaf is almost worthless to the spinner and weaver, many expensive processes have been evolved in order to take the leaf and other débris out. We can therefore understand that if there is much leaf and dirt in a consignment of rui a spinner cannot give a good price for it.

In our dry climate in the Punjab plains, where the leaves and

bracts of the cotton plant become brittle and easily broken very soon, it is probably more difficult to keep the kapas clear of leaf debris than in moister parts of the world, and this difficulty is greater towards the end of the cotton season, as the leaves are most brittle then. A great deal can be done to avoid leaf debris getting into the kapas, however, by picking the cotton in the early morning before the scorching sun has dried the dew off the leaves and made them comparatively brittle. Cotton picked in the early morning will, of course, be damp, and must be spread out in the sun to dry. Cotton which is kept in a damp state very soon loses its lustre and the fibre deteriorates in quality. Therefore do not sell damp cotton. If you do so you may cheat the buyer once, but next time he will merely reduce the price to protect himself against that.

The spinner also examines the length, strength, fineness, and smoothness of the rui. Some machines are fitted to deal with short fibre, other machines are fitted to deal with long fibre, but no machines are fitted to deal satisfactorily with consignments of cotton which are mixtures of both long and short fibres. Such consignments yield thread of unequal thickness with weak places in it, and with all the disadvantages of such thread. If the short fibre and the long fibre had been sold separately, the short fibre would have been bought by the people who had machinery to deal with it, and because they could have got an even quality of thread from it they could have given a higher price for it than could be given for the mixture. Had the longer fibre been sold separately it might possibly have fetched a far higher price than the shorter one fetched. Thus we see that by mixing our cottons of different lengths we not only lose the good price for the better quality of cotton in the mixture, but have every chance of getting a lower price than we would have got for the worse quality of fibre in the mixture had that quality been sold separately. Strength is, of course, a quality of importance, as weak cotton, whatever its other qualities may be, will always produce a weak thread, and must therefore always command a poor price. Fineness and smoothness are also characters of importance to some spinners, as fine thread can be produced from such rui.

Other buyers are, however, prepared to pay a better price for short, coarse cotton than for short, fine cotton, and as the zemindar's object is to grow a cotton which will bring him in a greater profit per acre, he may find it more profitable to grow a short, coarse variety in preference to a short, fine variety. Short, coarse cotton is supposed to be used for mixing with wool; the coarser it is the better it would be for this purpose.

Buyers complain bitterly against stained cotton in consignments of kapas, and state that zemindars would only keep the stained fibre separate from the good cotton the trade could offer a much better price for the good fibre, while the comparatively small amount of damaged fibre could be sold at a reduced rate. Stained rui like leaf debris causes trouble in the dyeing and bleaching processes, and gives a faulty-coloured cloth in the end. Stained cotton is also frequently weak, and as it is both difficult and expensive to separate it from good cotton a consignment containing stained cotton has a comparatively small value in the market. The stains on the fibre are

usually caused by insects attacking the bolls of the cotton plants, and cotton damaged in this way may be separated from the good cotton at the picking time, with little trouble. All that is required is that the picker shall have two pockets in his or her dress, and place the good cotton into one pocket and the damaged cotton into the other.

Having glanced at a few of the characters which must be possessed by a good cotton, and what we desire when we ask for an "improved cotton," let us look now for a moment at our original question, "How to improve our cotton crop." Enter almost any field of cotton in almost any part of the Punjab, and we find that it is an extraordinary mixture of many kinds of cotton. In 1908 the Agricultural Department had samples of the crops of *desi* cottons from every *tehsil* of every district of the Punjab, and many from the North-western Frontier Province, sent to Lyallpur. These samples were analysed and found in every case to be a mixture including many varieties and sub-varieties of *desi* cottons. These cottons have now been separated, and the seeds, &c., are being multiplied, and information regarding their cropping powers is being gradually collected annually. This year these cottons are on fairly large plots, and as an acre of a good crop of cotton yields enough seeds to sow nearly 20 acres next year we should soon have seeds of the selections sufficient to sow them on a large scale. We hope therefore to be able soon to supply comparatively pure seeds of any *desi* variety that a *zemindar* may fancy. We are finding that the red Multani cotton, for example, is an exceptionally heavy cropper and likely to give more profitable crops than the ordinary mixtures at present grown. This variety will therefore be recommended to *zemindars* who have farms in districts suitable for that variety and who wish to grow *desi* cottons. But how will we know which districts to recommend these cottons for? Well, we are at present sending men around in the cotton-growing seasons to discover what percentage of the different varieties of cottons are being grown in the mixtures in each district, and if we find that a certain variety preponderates in certain localities there is every chance that it will do well there. It will therefore be tried in these places on a comparatively small scale at first, of course, and we will accumulate facts and gain experience as we proceed. In this way we hope to displace gradually the mixtures grown at present by varieties specially suited to the localities in which they will be grown. Similarly, we find that the Narma and Dharwar American cottons usually grown in the Punjab are very bad mixtures of types, some having long fibre, some short, some rough, some fine, some plants being robust and good croppers, some habitually sickly and yielding comparatively little *kapas*. Work in the separation of these types was started even before the work on the *desi* cottons began, and the result is that we now have several comparatively pure types on a field scale. For example, there are this year over 100 acres of one variety which for several years has yielded a rather greater amount of *kapas* per acre than is yielded by average Dharwar American cotton, and for the *kapas* of which an Indian firm was prepared to give us Rs. 12-8 per maund, while they were only prepared to give Rs. 10 per maund for the *kapas* of the ordinary Dharwar cotton. We have other Dharwar and Narma varieties in the

course of evolution which we believe will beat even the above record, and these will be put forward in due time. We frequently meet people who tell us that the farmers here and their forefathers have been farming for very many generations, that they have nothing left to learn in farming, and that they do exactly what is best for themselves in each particular case. Many scorn the study of the sciences connected with agriculture and all such knowledge as can be imparted in an agricultural college. "What," say they, "is the benefit to us of being taught how to distinguish one variety of cotton growing in our fields from another? What is the value of being shown the characters of lint or of being told pretty tales about keeping our lint clean, about keeping our types of cotton separate, or about some person who has pleased the Agricultural Department by valuing a few seers of their lint at a fancy price? We will never get these prices." In case any such people read this article, let me tell the story of the Dharwar cottons on the 15th Lancers farm at Rissalwala, near here.

The manager of the 15th Lancers farm being a brother of my Teaching and Research Assistant, and being keen to improve the cottons, my assistant showed his brother which types of his plants to select seed from, and gave him all possible advice and assistance in selecting his cottons for himself. The year before last a firm of spinners sent a representative round here who willingly gave the 15th Lancers people Rs. 0-8 per maund more for their cotton than they gave for ordinary Dharwar cottons. Indeed, these were the only cottons which the firm cared to buy outside the Lyallpur Farm. It is the same firm who last year priced our Dharwar selection at Rs. 12-8, as compared with the ordinary Dharwar at Rs. 10. "Yes," some one may say, "but you must have a considerable consignment of one quality of cotton, otherwise it will not be worth an increased price to a firm, and if I grow a better staple of cotton on my little bit of land I will not get a better price for it, as it will simply be swamped among the other consignments in the Mandi. What can I do? I am entirely in the hands of my more backward brothers." True, that is a difficulty, and the Agricultural Department fully realise it. With a view to overcoming it the Department is trying to arrange that certain lands in the New Colony in Montgomery may be held on condition that the farmer will grow certain crops recommended by the Agricultural Department. It is to be hoped that with a command of this sort, over a large area of land and with the help of seed farms and other agencies, the Agricultural Department will be able to grow any improved crop in large enough quantities to be able to obtain the proper value of the produce in the market, and any small zemindar who grows that quality of crop will then be able to dispose of his small quantity of produce along with it at the increased price. With such an arrangement any zemindar will be able to profit at once by growing an improved crop, and will be entirely independent of his more backward brother.

If asked whether zemindars should grow desi or American cottons I would reply, "Each zemindar should grow the variety of cottons which will leave him most profit per acre." Conditions vary in different places to a great extent, therefore cases have to be con-

sidered individually before good advice can be given. If a zemindar's land is poor, and water and labour scarce, he will probably find desi cottons most suitable, as these cottons appear to be hardier in these respects. Even among the desi cottons, however, there are wide differences in suitability for growing in particular conditions, and if any zemindar cares to visit Lyallpur in the cotton-growing season I will be only too pleased to show him, or if I cannot personally attend, get one of my men to show him, how to distinguish the varieties and tell him what we know about them. Some of the desi cottons are most excellent croppers, and we frequently get 10-12 or even 16 maunds of kapas per acre from some of the varieties. Where the lands are specially suited for desi cottons, and while a good price can be had for short, rough lint, a good variety of desi cotton may therefore be grown with profit. Where land is of moderate quality, where water can be had at the proper time and in fair quantity, and where the soil can be fairly well cultivated, Narma or Dharwar cottons will probably be found more profitable. A most important point in the cultivation of these cottons is that they should get their water at the proper times. Any carelessness in this respect, more especially probably in the earlier stages of the crop's growth, has a very great effect on the out-turn. This is probably more marked than in the case of the American cottons. We often hear zemindars complaining of getting too little water, but while we admit that a fair amount of water is necessary, my experience has led me to the conclusion that an increase in the quantity of water is made far too much of—that if zemindars could apply at the proper time the same quantities of water as at present applied, and would till that land thoroughly, they would increase their out-turns of kapas to an astonishing extent. Cultivation of the soil is very backward here as compared with many other parts of the world, and the zemindar here would help himself very much if he would only improve that. An American gentleman who came round here some years ago was struck with the same thing, and told me that if they in America only gave their lands the same amount of cultivation as the ordinary zemindars here do, they would not get the price of the seeds from their cotton crop. "Why," he said, "if the zemindars can get such crops as I have seen with the cultivation that they give their fields, we would make our fortunes if we owned such lands."

Good types of Narma and Dharwar cottons have the advantage over desis that their lints are longer, and so are in demand in a wider range of market. In the past they have given me, on the average, a higher yield of kapas per acre, and the kapas is worth more per maund than that of desi. Both in the desi and American mixtures at present grown by ordinary zemindars in the Punjab, I find types differing vastly in cropping powers, in kan and in other very important points, and it is evident that if a zemindar would simply grow the best strain of cotton found in his fields he could, by the increase in quantity of rui alone, increase his profits handsomely. With the improvement of cultivation and the isolation of cottons of improved quality, and with improved facilities for marketing these cottons, I feel sure that in the Punjab desi cottons will in time, however, give place to Narma and Dharwar cottons, if no better sort is introduced. Already we hear that in Jhang district the desi cotton is being rapidly

displaced by ordinary mixed Narma. How much more probable is it, then, that desi cottons will be displaced by pure selected types of Narma and Dharwar?

Finally, I would add a word of warning. You have a large proportion of your capital invested in your crops, you know approximately the return you can get by continuing on your present lines, and you cannot afford to lose your capital by rushing rashly into new ventures. Conditions vary materially in different localities, and even on different farms of the same locality, so that individual cases must be considered where changes are to be made. Then study well the factors which combine to give you profit per acre from your crops, see what the Agricultural Department and the more advanced zemindars are doing, and learn what their results are; then begin on a comparatively small scale, and proceed according to your results. From what we have said I think it is evident that you will be able to improve your profit per acre from your cotton crop by merely growing pure seeds of the best types of cotton in the mixture which you are already growing; by improving the cultivation of the soil, by selling clean dry kapas, and by attending to the many other factors which combine to increase your profits, and which have or have not been mentioned in this article.

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Notes on Cotton.

(Received too late for insertion in the body of the Report.)

GWALIOR STATE.

Description of Cotton Cultivation.—Fields for the crop are prepared annually a little before the commencement of the rainy season. The seed is either sown broadcast and then ploughed over, or is sown deep. After germination, fields are weeded from three to four times.

Area under Cotton and Its Expansion.—There has been a steady progress in the cotton cultivation, more especially in the Malwa districts, where it is the only substitute available for opium to counteract the loss sustained by the restrictions imposed on opium cultivation. The total area under cotton in 1903 amounted to 236,602 acres, but it rose to 391,931 acres according to the final cotton forecast for 1913. The last decade has been favourable for expansion of the cotton cultivation, and it is hoped that it may further increase on the whole by 20 per cent. in the next decade, if cotton market remains brisk as in the past one.

Description of Cottons Grown.—Two species of the country cotton, “the ordinary one” and the other called “Ban,” are generally sown in the State. The American cotton has also made its appearance here and there, and its cultivation is very limited.

Yield per acre.—Yield per acre on unirrigated area is generally from two to five maunds, and on irrigated area between six and 10 maunds; but cotton grows on an unirrigated area to a very large extent.

Ginning Out-turn.—Cleaned cotton is usually one-third of the natural cotton, and its out-turn is nearly one-sixth bale or 33 seers per acre in the case of dry and nearly one-half bale in the case of irrigated lands.

INDORE STATE.

Only cotton producing yellow flowers is sown in Malwa. It is sown in June (Ashadh). About 20 lbs. of seed is required for one bigha = $\frac{5}{8}$ of an acre, *i.e.*, about 32 lbs. in an acre. The out-turn is about 200 lbs. an acre on dry land. On wet land the out-turn is nearly 300 lbs. an acre. The total cost per acre from sowing to picking is about Rs. 18/- in dry land and about Rs. 25/- in wet land.

For sowing cotton the land is prepared in the months of May-June before the rains set in. It is sown by the old Indian sowing machine, called “Nai.” Seed separated by the country “Charkha” is preferred to the one coming from the ginning factories. It is thought that in deep cotton soil, cotton suffers if the rainfall is heavy. Heavy rainfall is, however, good for cotton where the soil is shallow.

The cotton area during the last 19 years has risen from 58,173 to 482,969 acres. The record area was in 1911, when it reached 496,537 acres, and as the opium area is now contracted, cotton is the most paying crop and people are beginning to take to it. There are excellent prospects of the cotton area still increasing in the State. No experiments are yet made to see if other kinds of cotton can be grown in our irrigated fields.

GLOSSARY.

Bania .. ..	.. The shop-keeping Hindu, who is usually a money-lender.
Barani cultivation	Cultivation on rain water only.
Bakhar .. ..	.. Implement for loosening soil, inter-cultivator.
Beegah .. ..	.. Land measure of half an acre.
Berseem .. ..	.. Egyptian clover.
Bosi Crop .. ..	.. A crop grown on land previously flooded from a canal.
Bund .. ..	.. Embankment (generally applied to river embankments).
Charki cultivation	Cultivation irrigated by lifting water on to the land.
Chowkidar .. ..	.. Watchman.
Cusecs .. ..	.. Cubic feet per second in irrigation.
Dayabhaga .. ..	.. Hindoo family system, according to which a division of property takes place after death.
Dalal .. ..	.. Broker.
Dokra .. ..	.. Small, loose bale.
Dubari .. ..	.. A second crop grown on the strength of the first crop's watering.
Duffardar .. ..	.. In Assam a gangman, who recruits also labour.
Godown .. ..	.. Store.
Gur .. ..	.. Raw sugar.
Hari .. ..	.. Cultivator.
Jaitha .. ..	.. Storing space, allotted on cotton green.
Jagir land .. ..	.. Land granted revenue free, either in perpetuity or resumable in whole or in part on the death of the guarantees.
Jagirdar .. ..	.. Holder of Jagir land.
Jogari .. ..	.. Raw sugar.
Kacha .. ..	.. Land thrown up by river silt, unsettled, temporary.
Kalar land .. ..	.. Land impregnated with salts.
Kan .. ..	.. Ginning out-turn.
Kapas .. ..	.. Seed cotton, unginned cotton.
Kharif crop .. ..	.. Sown before rains in June and harvested in winter.
Kharif season .. ..	.. Inundation or flood season, taken as April to September in the Punjab and in Sind.
Khoso pani .. ..	.. "Sour" water run off from rice fields to allow of fresh water taking its place.
Lakh or Lac .. ..	.. One hundred thousand.
Lumbradar .. ..	.. Head of village council.
Mahajan .. ..	.. Money-lender.
Malkano .. ..	.. The payment made to Government on new land for the right of occupation.
Marwari .. ..	.. Large commercial class in India, often money-lending.
Mitakshara .. ..	.. Hindoo family system, according to which all form a corporate body; no division of property after death.

Moke cultivation	..	Cultivation by flow from canals.
Muccadam	..	Head man of a gang of labourers.
Patwari	..	Village accountant.
Pir	..	Mohammedan priest—a hereditary title.
Punchayat	..	Village council.
Rabi crop	..	Sown in autumn and harvested in summer.
Rabi season	..	The season when the river is low, taken as October to March in the Punjab and in Sind.
Ran	..	Desert.
Rui	..	Lint, ginned cotton.
Ryot	..	A peasant farmer.
Ryotwari system	..	Individual occupancy of land, universal in Bombay, Madras, Assam, and Burma.
Sailabi cultivation		Cultivation on land which has been flooded from the river.
Assessment	..	Classification of land into degrees of fertility according to which land tax is levied.
Settlement officer	..	The Indian Civil Service official who is entrusted with the task of classifying the fertility of soil.
Takavi	..	Advances made to cultivators by their landlords, and by Government to their tenants, for the purchase of seed, or for improving their canals.
Taluka	..	Revenue subdivision of a district.
Wa	..	Cotton in Burmese.
Wah	..	Canal.
Zemindar	..	Landowner in Sind; in the Punjab, ordinary cultivator.
Zemindari system		Landlord system of land tenure, universal in the U.P., C.P., Bengal and Punjab.

ABBREVIATIONS.

I.C.S.	..	Member of the Indian Civil Service.
C.I.E.	..	Commander of Indian Empire.
C.S.I.	..	Commander of Star of India.
K.C.S.I.	..	Knight Commander of Star of India.

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